EDITORIAL

THERE used to be a standing joke about hi-fi fans in particular that, in order to pursue their activities to the limit and obtain the astronomical results which tradition demanded they should seek, many of them would install their equipment and then build their houses around it.

I think we have all seen funny cartoons on this subject, with huge speaker horns extending over the local countryside or up into the air.

Today the idea of tailoring one's home to accommodate the various types of entertainment the modern family demands isn't at all fantastic. In fact, in the immediate years to come it may well be a logical necessity.

In the old days, when people made their own entertainment, the focal point of the living-room was often a piano played by the girls of the household, or a pianola played by anybody, supported occasionally by a gramophone whose trumpet took up a position in a convenient corner.

Today we are receiving more and more of our home amusements from outside. Already there are two important items, TV and the radiogram, which demand considerable thought in the arrangement of a living-room. Now that stereo has arrived, and seems certain to extend its importance and use, quite a few problems are involved if the users are to derive benefit from it.

The move towards enjoying our entertainment in the home rather than by making excursions to concert halls and picture theatres is bound to continue, and even today people are learning to include facilities for their private recreation unit as part of normal living facilities.

There seems little doubt that, in the measurable future, our TV screens will be replaced with larger, wall mounting displays which will take up considerable space at one end of the room, together with sound reproducing facilities for both radio and TV.

We might use our imagination and consider the possibility of luminous pictures in colour which can be changed at will and form a new motif in decoration.

The builder of a new home may not yet need to look quite so far ahead, but he would be short-sighted indeed if he did not so arrange matters that he and his family can make the most of all these growing facilities to make his life more pleasant and profitable.

John Moyle

And, to quote a saying which once we used to account for our growing list of marvels, "it's all done by wireless."

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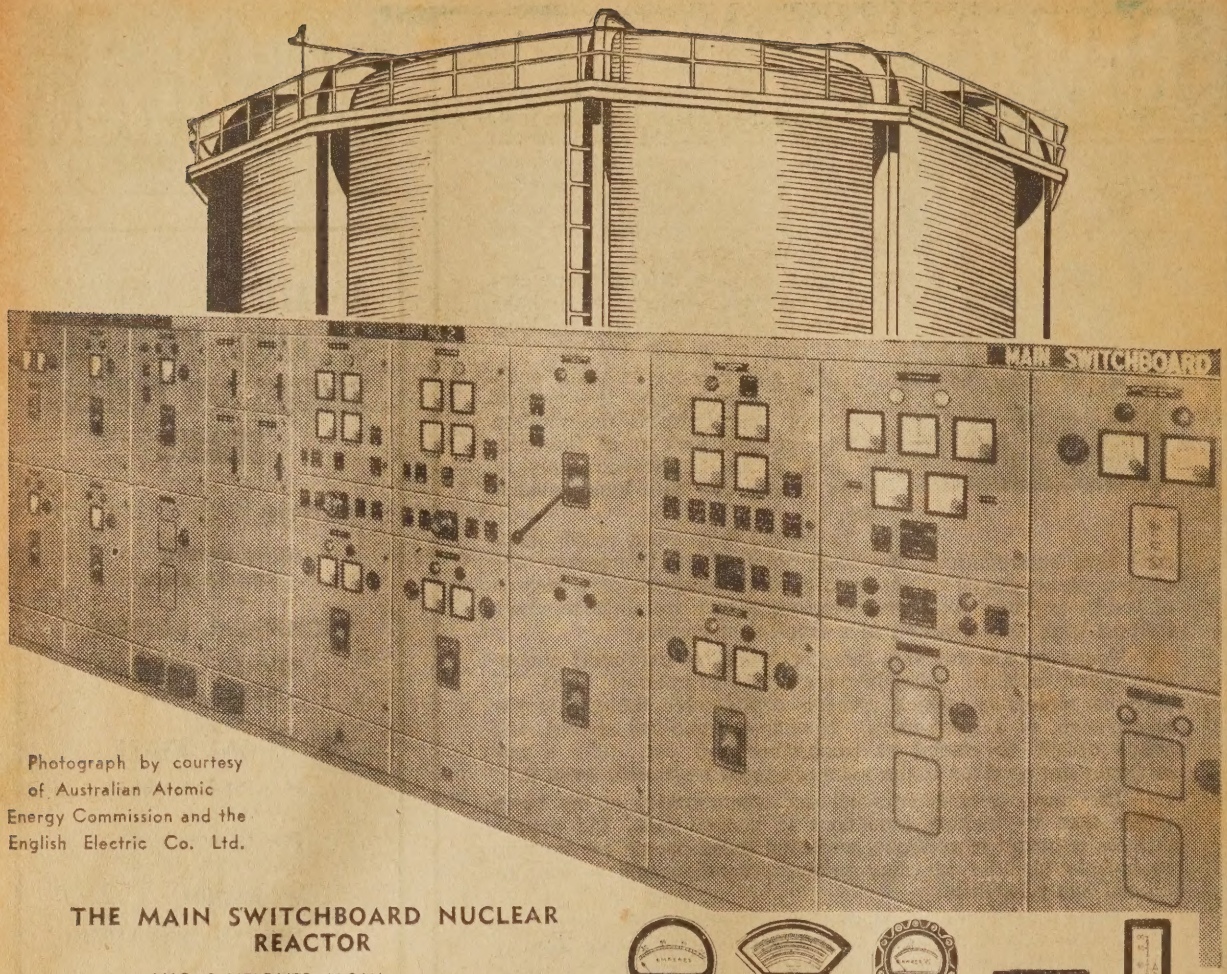
OUR COVER PICTURE

Newly released photograph of the Armstrong Siddeley Gamma engine which took Britain's first Black Knight rocket out of the earth's atmosphere. It has four rotatable combustion chambers, a total thrust of 16,400lb, rising to 19,000 outside the atmosphere. The engines are used at Woomera.



Photograph by courtesy of Australian Atomic Energy Commission and the English Electric Co. Ltd.

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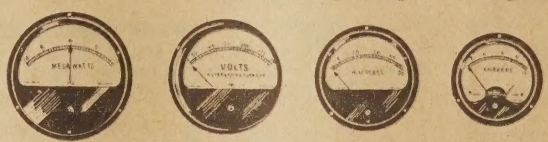

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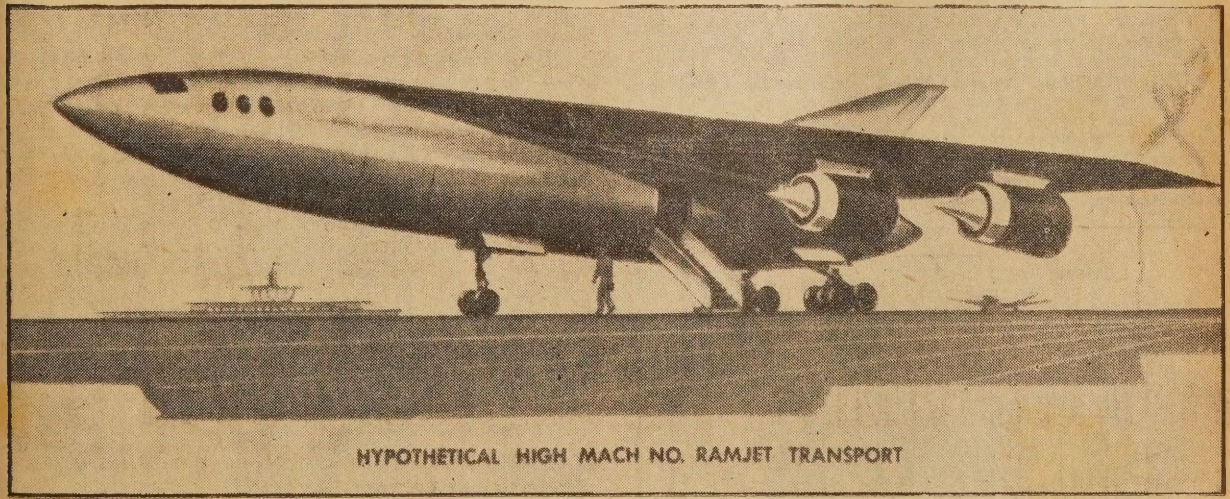
RAMJET FOR SUPERSONIC FLIGHT

Artist's conception shows three views of a hypothetical high Mach number transport which the Marqardt Aircraft Company claims could fly up to Mach 4 at 80,000ft. It is a ramjet, and would require little modification of techniques or materials being used today.



HYPOTHETICAL HIGH MACH NO. RAMJET TRANSPORT

This is how the transport would look on the ground. It would weigh about 300,000lbs, and carry 100 passengers. The time required to fly the American east-west route would be about one hour. The designers believe the ramjet entirely feasible for supersonic air travel.

Can We Catch Up with Russia on A-PLANES?

By ALDEN P. ARMAGNAC

Ever since the use of nuclear power became feasible, its application in aviation has presented probably that greatest challenge. As aircraft become bigger and faster, their power plants grow increasingly more difficult to design and their fuel requirements multiply. In this article the writer reviews the progress, or lack of it in the United States and Russia which, with Great Britain, are probably the only nations in the world capable of mounting such a project.

BARELY more than a year after the Russians sent up the first Sputnik came reports that they were secretly test-flying the first atomic-powered aeroplane.

If so, another stunning technological victory over the United States will have been handed to Reds virtually by default.

When the A-plane race began, soon after the end of World War II, the U.S. had every opportunity of winning. Today, after spending 13 years and upward of 700,000,000 dollars on it, there is still no A-plane. And we may wait three or four more years for one—unless a drastic speed-up should result from the imminence or fact of Russian success.

Although the White House and the Pentagon were sceptical of the unofficial reports that an A-powered Red bomber was flying already, there was little doubt of its happening soon. The man who heads the Aircraft Nuclear Propulsion Program —Major-General Donald J. Keirn, of the U.S. Air Force— had conceded the Russians a good chance of getting an atomic aeroplane into the sky first, possibly early this year, if not before.

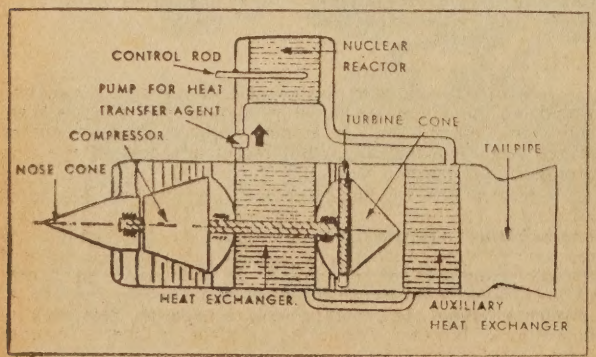
The Reds' first A-plane might not be too sophisticated a flying machine, it was suggested.

NO MAKESHIFT

Prophecy and product. In contrast were advanced Soviet designs in a handbook titled, "Applications of Atomic Engines in Aviation," published in Moscow in 1957 by the Ministry of Defence of the U.S.S.R., and highly enough regarded in the United States to have been translated into an English edition at Wright Patterson Air Force Base.

And the Russian A-plane reported actually to be making test flights was no makeshift, but an impressive military prototype, according to its description.

The magazine, "Aviation Week," described the plane seen by Western observers over Moscow and on the ground as a delta-winged bomber of about 195-foot length, 78-foot wingspan, and 300,000-pound gross weight. It was said to be powered initially by two atomic turbojet engines, already "definitely tested in the air"; and two conventional ones, later to be replaced by A-engines.



Its reported speed was in "high subsonic and low supersonic range"; its "thin, high-speed aerofoil," implied a higher future goal. But what makes the A-plane a revolutionary military weapon is one simple and staggering fact: its unlimited range.

Without need of refueling, it can circle the globe again and again. It can fly as far, or for as long, as sandwiches and coffee hold out for the crew.

A Russian A-plane "first" would betoken an ominous lead toward rolling out A-planes in quantity. A Red A-plane fleet, with no counterpart, could place this and other countries in mortal danger.

A-FLEET IN ACTION

Imagine, says Gen. Keirn, an enemy A-fleet constantly circling the sky off our shores—just beyond reach of our warning radar net. With long-range missiles launched from the air, this aerial armada at any moment could loose a surprise nuclear blitz upon our military, industrial and population centres. Then, swooping in low over paralysed defences, it could liquidate surviving targets at pointblank range.

Currently, Strategic Air Command's "ground alert" concept calls for 15 minutes' warning time to get bombers aloft from its missile-vulnerable bases. But with A-planes an "airborne alert" system, keeping S.A.C. bombers always in the air, would be feasible. That would deter surprise attack by insuring the survival of an effective retaliatory force.

Designed especially for that mission, the A-plane now sought may be visualised as a fast-missile-armed turbojet craft, capable of prolonged flight with a heavy payload, perhaps similar to a B-52 in size and weight.

By latest report the Air Force now surprisingly favours a hybrid A-engine—a nuclear-powered turbojet, combined with an afterburner using ordinary fuel for extra thrust when needed. At this writing the Air Research and Development Command reportedly was studying A-plane designs by Convair and Lockheed, before deciding whether to award a contract to build a prototype.

While the Air Force's A-plane program is called the basic one because of the A.F.'s "high-priority strategic mission," the Navy also has an A-plane project. Interested in a nuclear turboprop seaplane, the Navy would be happy with the slower propeller-driven craft, which it would use to transport heavy cargoes to remote outposts.

Engineering studies by the Martin Company are under way—but the Navy's A-plane, like the Air Force's, exists so far only on paper.

A-ENGINE DESIGNS in Russian handbook, translated at U.S. air base, show advanced Red concepts. Example is this A-engine with an "atomic afterburner," or auxiliary A-heater for air, in tailpipe. In contrast, U.S. plan combines A-engine with afterburner using ordinary fuel.

For, before the A-planes, must come their A-engines. Two possible kinds, both under U.S. development, apply the same basic idea. A uranium-fuelled reactor, or atomic furnace, replaces a flame to heat the air stream rushing through a turbojet or turboprop engine, and so to yield a propulsive force.

In the simpler kind of engine, the air stream flows right through the hot reactor. Since the air spewed out the tail pipe is radioactive, this is the "dirty" A-plane. (A more polite name: direct-cycle.)

Because the radioactivity is extremely short-lived, the exhaust will not contaminate the atmosphere. Nor will its radioactivity harm a bystander far enough away not to be burned by its heat.

But dust from the launching runway, sucked through the engine, could acquire lingering radioactivity, and cause serious contamination by settling back on the runway—which may, therefore, need to be water-sprinkled or otherwise freed of dust before a take-off.

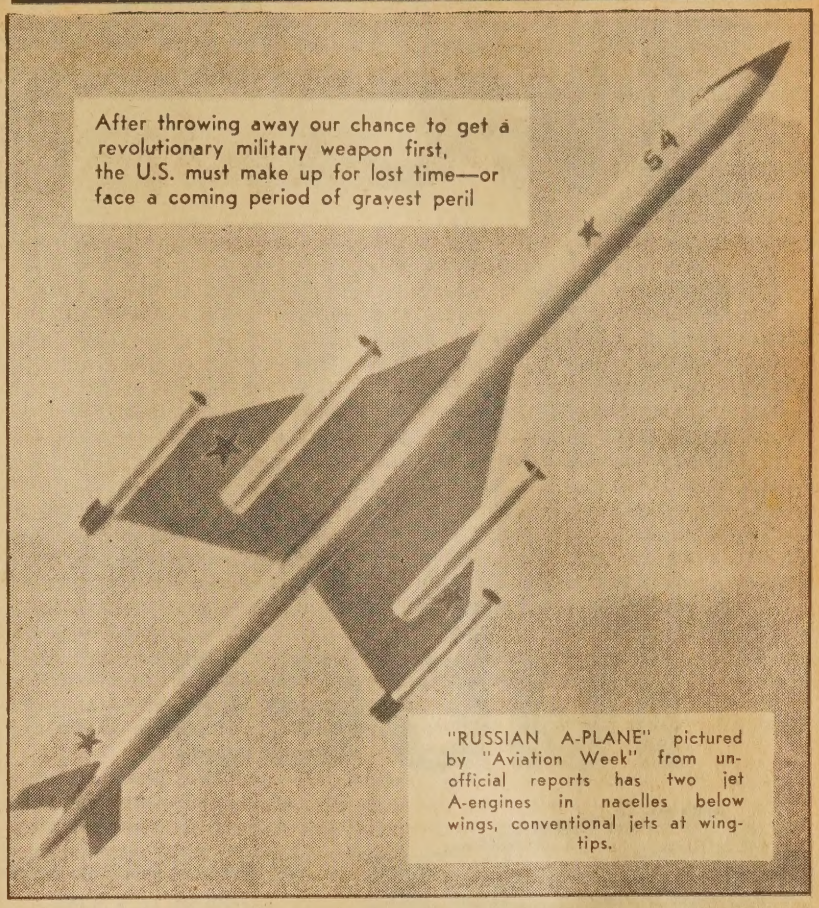
HEAT EXCHANGER

The alternative scheme conveys a reactor's heat, with molten metal for instance, to a heat exchanger in the engine; and this device heats the air stream. This is the "clean" A-plane. (Another name: indirect-cycle.)

The "dirty" A-plane engine appears to be the one further along in the U.S. —as perhaps also in Russia, whose reported "A-plane" was said to be a "dirty" one.

At the Idaho test site of our A-plane program, General Electric has been trying out engines of this kind, developed at its Evendale, Ohio, plant. A "clean" A-engine, of which little has yet been heard, is under development by Pratt and Whitney at a newly-built Middletown, Conn., nuclear-engine laboratory.

ARTIST'S IDEA OF RUSSIAN PLANE


After throwing away our chance to get a revolutionary military weapon first, the U.S. must make up for lost time—or face a coming period of gravest peril
54
"RUSSIAN A-PLANE" pictured by "Aviation Week" from unofficial reports has two jet A-engines in nacelles below wings, conventional jets at wingtips.

Ground Tests. So far as has been publicly revealed, the principal result of our whole A-plane program to date has been successful operation, on the ground, of two turbojet engines under atomic power.

This was accomplished at the Idaho site by General Electric in 1956-1957 trials. Piped to a stack, the engines' radioactive exhaust was dissipated high above ground. Their metallic-fuelled, water moderated reactor was the first to approach the high power required for an A-plane—but its size looked more suited to the engine-room of the Queen Mary. (One reason, said GE: extra-heavy shielding, to let experimenters get near.)

Similar, more-advanced secret trials followed—until the latest reactor's controls failed, accidentally loosing enough radio-activity to contaminate 1,500 acres of the site. Pending repairs to the reactor if possible, tests halted. Still to be completed was the first Idaho facility able to ground-test a flyable engine.

That was the way our A-plane program stood as this was written.

The answer has two parts. First come the enormous technical difficulties:

The men in the A-plane are its biggest problem. Shielding must protect them from the radioactivity of a reactor of perhaps 300,000 kilowatts or more, powerful enough to light a whole city; unshielded, it would endanger a person a mile away. The shield will be the heaviest part of the plane—whose size, design, ability even to fly at all, depend upon just how heavy the shield must be.

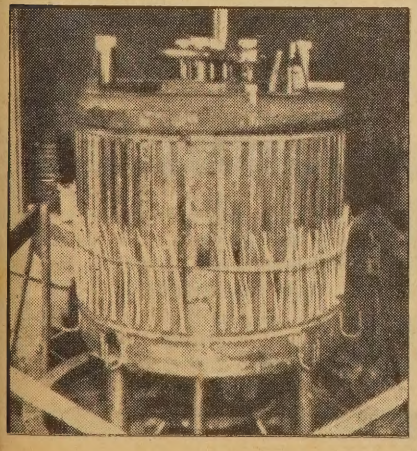
And that hangs in turn upon the agonising question of how much radioactivity an A-plane crewman should be asked to take.

For limited periods, instead of the usual ultraconservative standard for everyday exposure, something nearer an accepted "emergency" dose might apply

ONE-SHOT CREWS

There has even been serious talk of one-shot crews who would use up a lifetime's radiation allowance in a single flight and then, "burned out" in atomic workers' slang, would be retired from A-plane duty. But recent advances in shielding promise a less extreme solution.

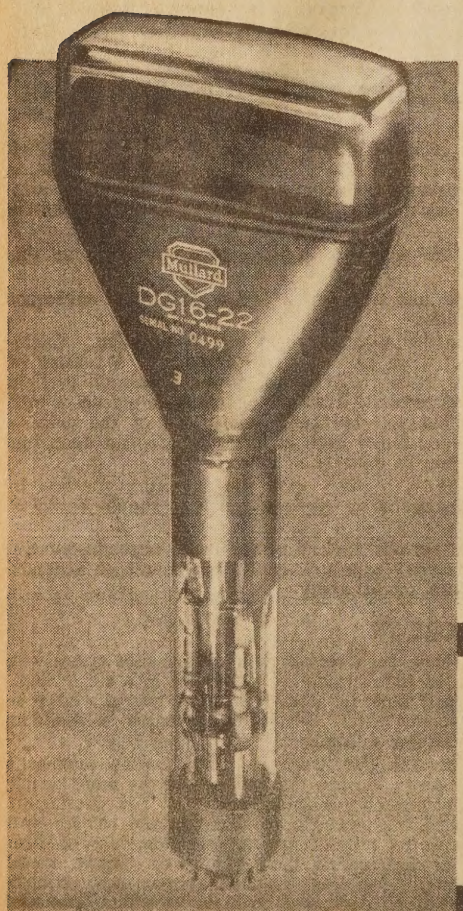
Specifications for the A-engine itself are an engineer's nightmare. The hotter it runs, the better—but the more nearly impossible to find materials that can stand up. The smaller the reactor, the simpler the problem of shielding and weight—but the more difficult to provide for an extreme rate of heat transfer, and for unimpeded flow of air or liquid metal through thousands of passages. Irreconcilable as these requirements look, however, dedicated A-plane workers consider them a challenge.



☆

Running red-hot on molten uranium-salt fuel, this three foot high atomic reactor yielded a modest 2,500 kilowatts in "Aircraft Reactor Experiment" at Oak Ridge in November, 1954.

Two Mullard Tubes



2¾″ general purpose tube
DG7-5 (CV2175)

The DG7-5 has a low operating voltage and is intended for symmetrical deflection. It is being successfully employed for wave form monitoring and for inexpensive oscilloscopes.

5½″ x 1½″ flat A-scan tube
DG16-22/7APHI (CV2352)

The screen of the DG16-22 measures 5½″ x 1½″. A number of these tubes can be easily stacked to provide multiple displays in confined spaces.

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The sorrier side. The other side of our A-plane's earthbound status to date is a story of handicaps of a different sort.

Given its first home in tar-paper shacks in a state of disrepair, left over from the wartime Thermal Diffusion Plant at Oak Ridge, Tenn., our A-plane program has been an ugly duckling from that inauspicious beginning. Early and influential opposition to it amounted to a veritable intrigue. Opponents of the project brought about its review in 1948 by a MIT scientific group, reportedly expecting an unfavourable verdict that would kill it; instead, the resulting Lexington Report endorsed it as feasible.

COSTLY AND DIFFICULT

Hampering later progress, say staunch friends of the program in Congress, have been divided responsibility, indecision, cutbacks in funds. Developing an A-plane is expensive business (only three nations could afford it, the U.S., England and Russia, an expert has said) and Government economy waves have taken disastrous effect. Plans to flight-test an A-powered B-36 were cancelled in 1953; a supersonic A-bomber project, Weapon System 125A, was called off in 1956.

And only last year, a "Fly Early" proposal to adapt an existing plane to A power was rejected, on the ground that it would divert effort from the ideal A-plane we hope to get some day. With that Administration-backed decision, defence officials resigned themselves to seeing a Russian one fly first.

What happens now? Can we catch up with the Russians, before swarms of Red A-planes menace us? That will be a "hot subject of inquiry" in the present session of Congress, prominent members promise. And if nothing else can spur our lagging program, perhaps the Sputnik-like shock of a publicly flaunted Russian A-plane will. Americans can only hope it will be in time.

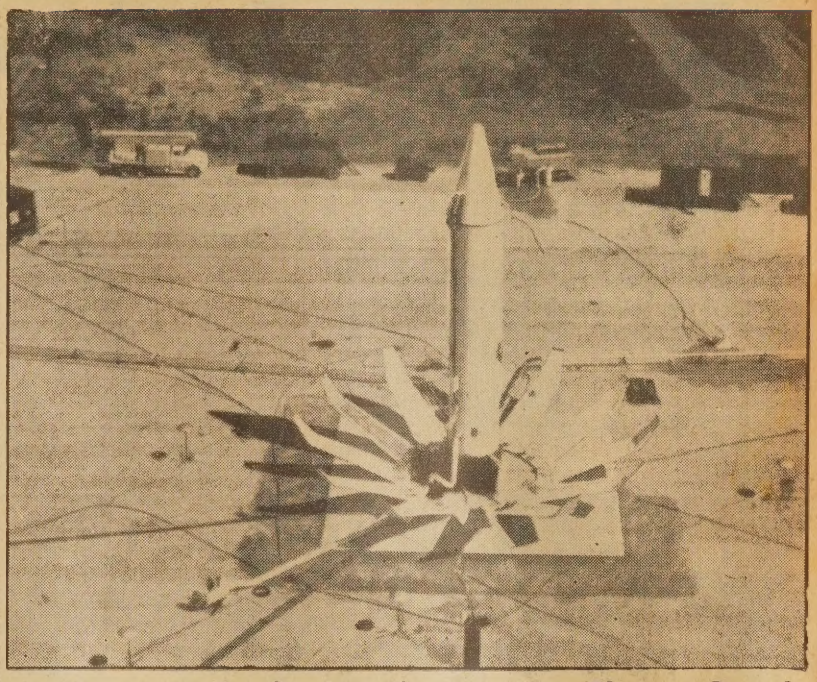
NEW PLASTIC INSENSITIVE TO ULTRA-VIOLET

Outstanding stability to heat and light is the property ascribed to Tinuvin P, an ultra-violet barrier for plastics. Its structure, which contains a carbon-hydrogen-nitrogen cyclic unit known as triazole grouping, whereas earlier barrier substances are generally based on the organic chemical benzophenone, is believed to confer resistance to oxidation on some polmers and so to result in improved colours.

Thus in the case of polystyrene, it has been found that the additive improves the clarity and offers adequate protection against degredation by ultra-violet radiation, an asset in light fittings or transparent packaging where sensitive contents of the package can therefore also be protected in this way.

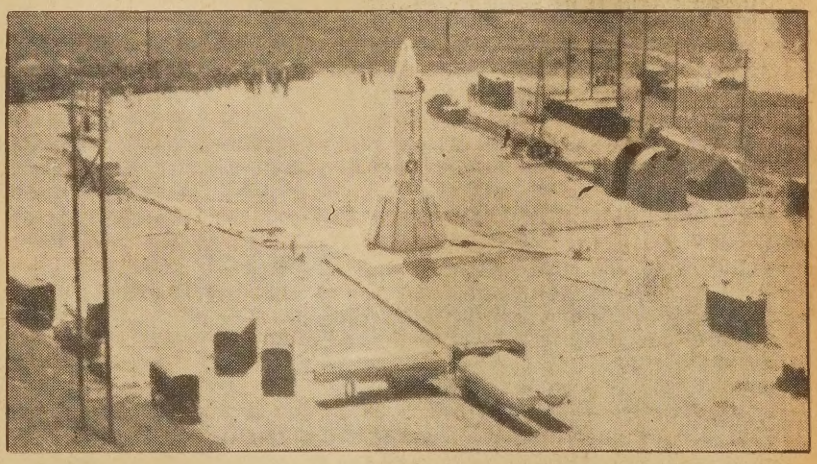
Tinuvin P is already being used in several countries, including Great Britain. Investigations now in progress are expected to lead to further applications. For example, it is being examined as a possible lacquer coating for materials like printed textiles and leather cloth, as polishes for wood or certain plastic surfaces, and for use in synethetic fibres and foamed plastics to retard yellowing.

NEW JUPITER MISSILE SHELTER



Jupiter Missile Shelter Opens Like Flower Petals

A new type of protective shelter has been designed to protect the Jupiter missile between installation and use. The illustrations show how the cover sections open outwards when firing moment arrives, greatly simplifying the process and saving considerable time. The latter is likely to be an important factor when the missile is ready for use.



MEN CAN TOLERATE ACCELERATION INTO SPACE

SELECTED men are able to tolerate the acceleration program of a three-stage rocket capable of putting them in orbit about the earth.

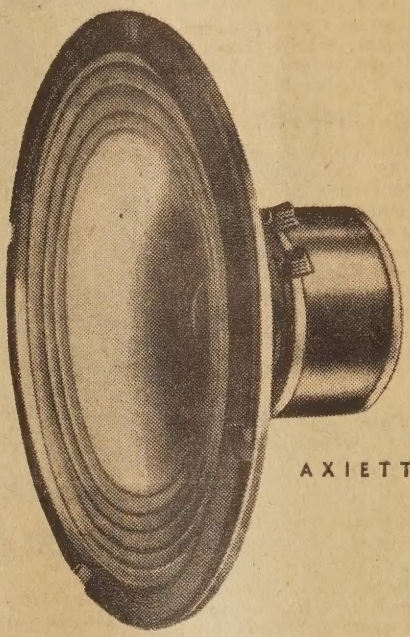
Accelerations below 4 g (128 feet per second per second) are tolerable for long periods: peaks up to 12 g are tolerable for the periods needed to achieve orbital speed. The best position appears to be one seated, facing the direction of flight, with the body tilted forward from the hips by an angle of 25 degrees.

For withstanding the decelerations of re-entry into the earth's atmosphere, it is better to swivel the man around to face the tail of the vehicle. However, he can tolerate decelerations facing forward provided these are less than 6 g. It is probable that he will also be able to tolerate brief decelerations of up to 12 g, but he will then be nudging the limits of endurance.

Especially...

where SPACE is LIMITED

FOR STEREO



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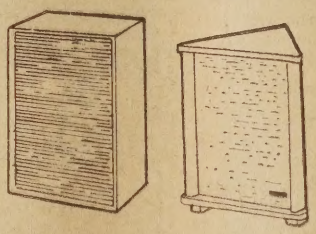

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ELABORATE SYSTEM AVOIDS ECHO AND SOUND CONFUSION

A unique "no-echo" sound system, the first ever installed in Australia, is incorporated in Melbourne's Sidney Myer Music Bowl, which was officially opened by the Prime Minister (Mr Menzies) on February 12. The system, which was designed and supplied by Philips Electrical Industries Pty. Ltd., is the most advanced of its type in the world.

THE Bowl, a glittering, tent-like structure of plywood and aluminium skin stretched on huge steel cables, it situated in the Domain Gardens, St. Kilda Road. It can seat 2,000 people under its canopy, with space for an audience of more than 100,000 on the surrounding lawns and parklands.

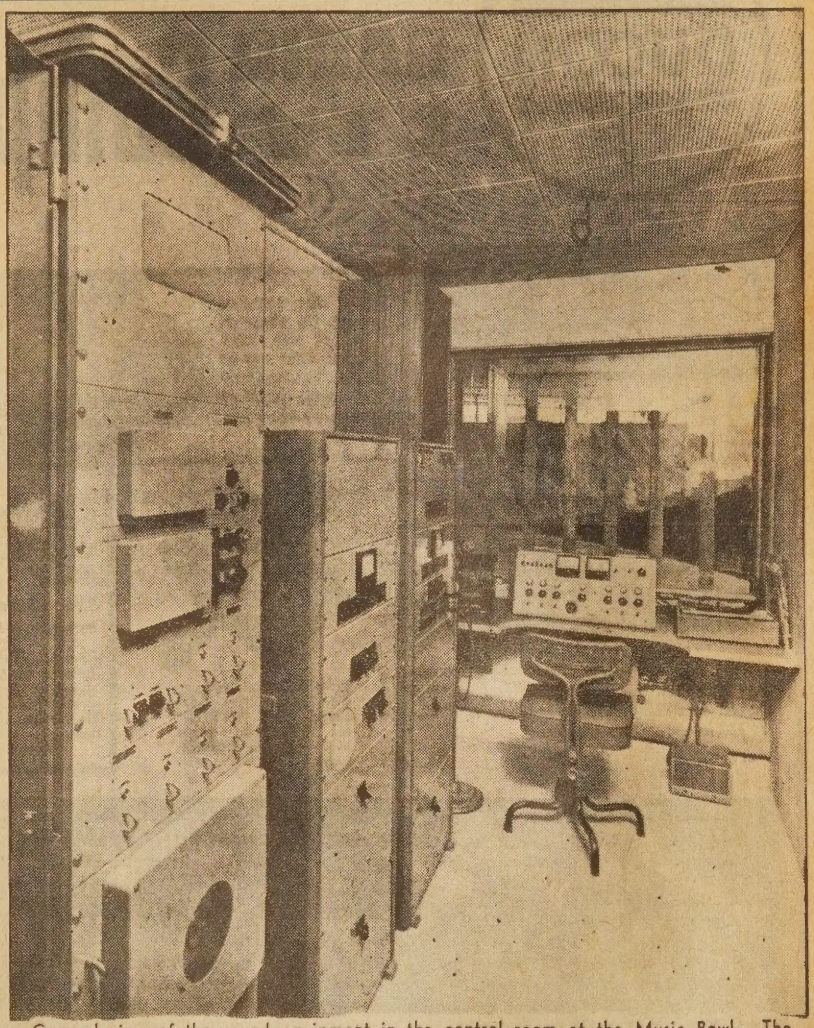
After the colorful opening ceremony, the visiting American conductor, Alfred Wallenstein, who conducted the Melbourne and Sydney Symphony Orchestras at the initial recital, described the acoustics in the Bowl as "magnificent."

To achieve this high quality in sound reproduction, sound experts used latest overseas methods and devised new techniques to overcome local problems.

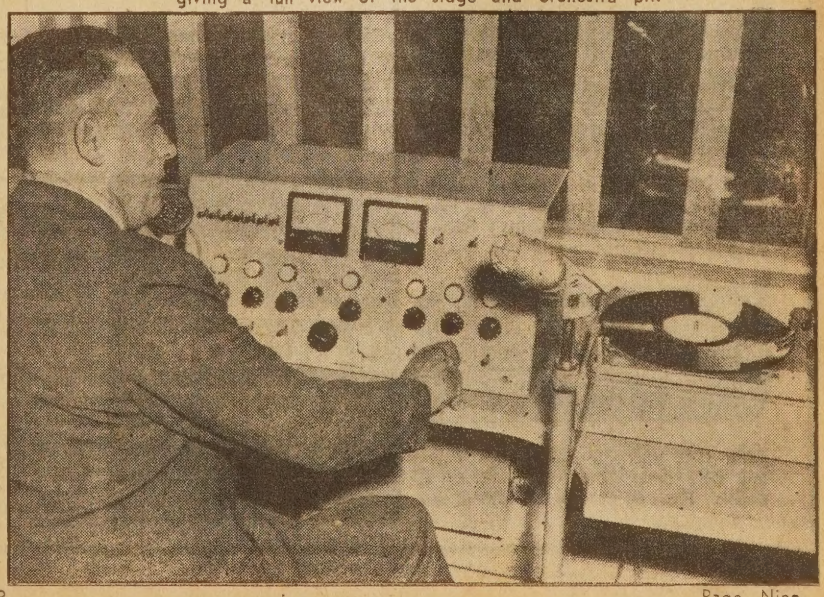
NOVEL FEATURES

Among the most important sound innovations in the Bowl are:-

- an "artificial reverberation" system which eliminates echoes and sound confusion normally present with loudspeaker installations.
- narrow-angle "beaming" of loudspeakers so that the level of sound appears constant in all sections of the bowl.
- a bathtub-size control point in the centre of the lawn 20 feet from the stage in which an operator can sit to hear the same sound as the listening audience and control it on a specially-built miniature control panel. This can be done to much better effect in certain circumstances by an operator actually in the main listening area than by the regular monitors in the off-stage control room who hear only the sound reproduced through their headphones.
- a special hook-up provision to enable



General view of the sound equipment in the control room at the Music Bowl. The control room is on the left hand or western side of the stage, with glass panels giving a full view of the stage and orchestra pit.



An operator at the sound control panel. The glass panels give an uninterrupted view of the 8,000 square feet of stage and orchestra pit, where there is provision for 21 separate microphones.

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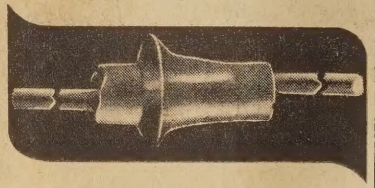
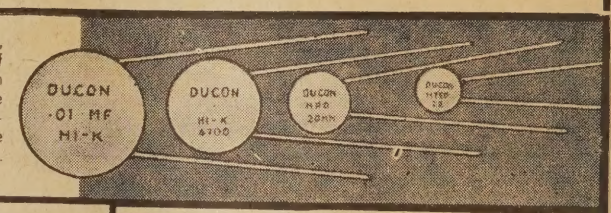
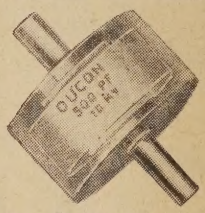
TYPE CAE—Screw mounting stand-off variety in capacity ranges of 100 pf. min. to 3000 pf. max.



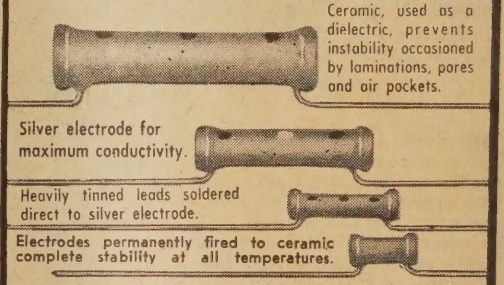
TYPE CAC 100—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.

The disc ceramic, with its short rf current path, when soldered direct to the tube terminals, reduces the inductance to very small values.





Type TV high voltage disc capacitors encased in "DURITE" for T.V., and other high voltage applications.



Ceramic, used as a dielectric, prevents instability occasioned by laminations, pores and air pockets.

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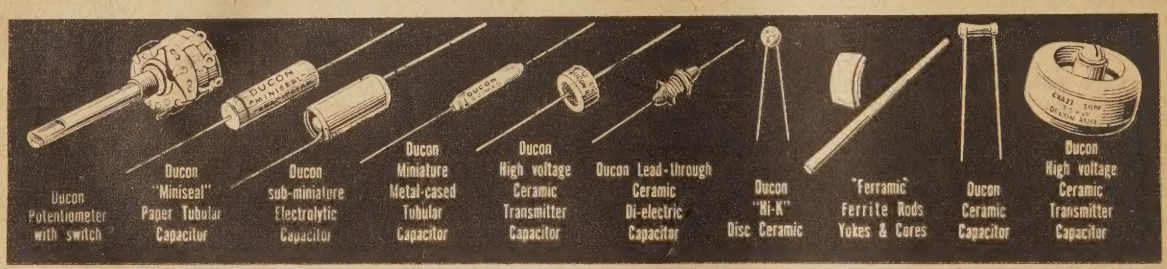
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Ducon Miniature Metal-cased Tubular Capacitor
Ducon High voltage Ceramic Transmitter Capacitor
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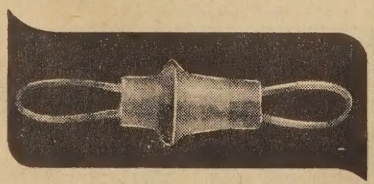
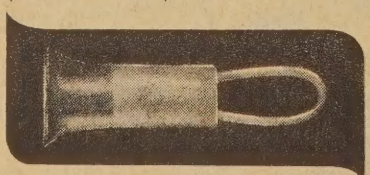
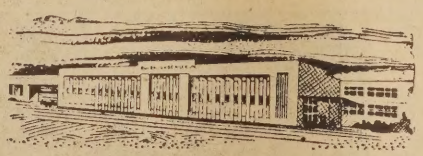
"Ferramic" Ferrite Rods Yokes & Cores
Ducon Ceramic Capacitor
Ducon High voltage Ceramic Transmitter Capacitor



TYPE CAC—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.



TYPE CAE 100—Stand-off flange mounting style mounted by soldering to the chassis. From 50 pf. min. to 1500 pf max.



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any broadcast network, whether radio or TV, to broadcast performances without having to supply extra equipment.

The "artificial reverberation" — or "no-echo" — system, which has been installed in the famous La Scala Opera House in Milan and is under consideration for the proposed Sydney Opera House at Benelong Point, works on the principal of sound delays.

In a large auditorium the listener may be closer to a loudspeaker than to the actual sound source on the stage. This means that he hears the sound first from the loudspeaker and then, a fraction of a second later, from the actual sound source. The result is poor intelligibility or "fuzziness."

The Philips system remedies this defect by automatically delaying the sound from each loudspeaker so that it reaches the ears of the audience at the same time as the natural sound coming from the stage.

Heart of the system is the control room on the left-hand (western) side of the stage. Through this are connected the seven microphone terminals (each with provision for three separate microphones) placed at various positions on the stage and in the orchestra-pit.

SIX MICROPHONES

Up to six microphones can be used at the one time, depending on the type of performance. Signals from these, as well as from a record player used during breaks in stage performances, are mixed at the control panel and fed at the correct levels to the two amplifying channels.

One channel, which incorporates the "artificial reverberation" system, leads to the three sound columns serving the lawn area of the bowl, while the other feeds directly to the two "sound columns" on either side of the orchestra-pit.

These "sound columns" are batteries of 12in loudspeakers—40 in all—which are specially angled to give an overall uniformity of sound throughout the auditorium and over the lawns beyond.

The two sound columns near the orchestra-pit are placed 50ft from the ground and each contains five loudspeakers. The two columns—mounted 60ft high near the 70ft masts supporting the canopy in front of the lawn area—each contain 12 loudspeakers, while the column in the centre behind the seated area contains six.

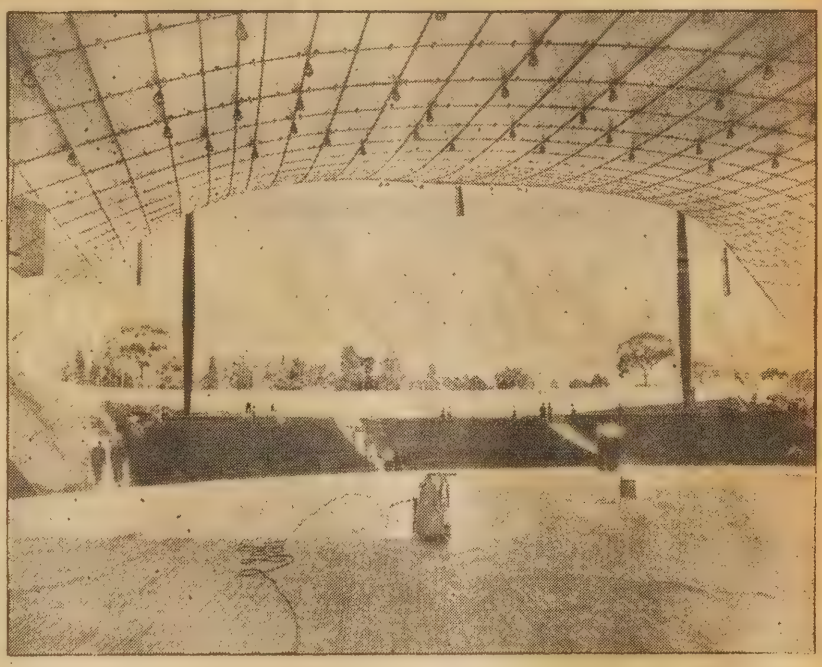
SPECIAL SPEAKERS

The loudspeakers themselves were specially developed in co-operation with the C.S.I.R.O.'s Building Research Division. Made of alumply sheets with a fibre-board acoustic tile on the inner surface, they are designed for top-quality reproduction over a long period of rugged "outdoor" operation.

The bathtub-size control point in the centre of the lawn area, which is the first ever built for this type of music bowl, will be particularly useful when it is desired to create unusual effects by means of the reverberation and sound delay equipment. Because these effects take into account the acoustic properties of the bowl, an observer located among the audience can exercise better control over the sound as it is heard in the area rather than as it exists at the loudspeaker point.

The bowl's stage microphones are "pencil" dynamic and condensor types, which ensure high-quality pickup. One of the microphone racks contains a 200-watt battery/mains amplifier fitted as an emergency unit, which can be connected to any of the speaker lines should the mains' supply fail. This enables announcements to be made to the public during the period of emergency. When not being used for this purpose, this amplifier may be used to "page" artists in the dressing-room areas.

SOUND COLUMN SPEAKERS USED



General view of the Sidney Myer Music Bowl from the rear of the 110ft by 70ft stage. Four of the five sound columns (batteries of loudspeakers) are shown one at top left above the stage and three across the edge of the canopy. The fifth is above the other side of the stage, not shown in the picture.

Thanks to the painstaking efforts of highly skilled sound engineers, Melbourne music-lovers now have an auditorium which is as acoustically perfect as modern electronics can make it. This quality, together with its unique construction and setting, makes the Myer Music Bowl one of Australia's most important contributions to the world of culture and entertainment.

Demonstrated recently in Britain for 14 to 16 feet outboard motor boats were these hydrofoils which lift the boat clear of the water at speed. A 16ft aluminium runabout capable of 30 mph with a 35 h.p. motor is claimed to reach 40 mph with the seawings which are retractable.

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WORLD'S LARGEST CLASS USES TV

PHYSICS PROFESSOR TEACHES 270,000 STUDENTS EACH DAY

A bold experiment designed to help close the dangerous gap in America's science education is making television history this season. Since last October, the National Broadcasting Company has been pioneering the first college-level course taught on a television network

Presented for a half hour five times a week at 6.30 a.m., "Continental Classroom" brings the nation skilled instruction in atomic-age physics—and gives Professor Harvey E. White as many students as it would take a conventional instructor, lecturing to five regular classes a day, 1,300 years to teach.

From the time it was launched, the program began proving itself the country's most dramatic measure to meet the post-Sputnik educational emergency declared by President Eisenhower. It prompted 149 television stations to clear time, and 250 colleges and universities across the nation to offer full academic credit for the course.

270,000 VIEWERS

Intended chiefly to repair the shortage of competent high-school physics teachers, the two-semester course has drawn more than 5,000 teachers who are taking it for credit. Beyond that, it inspired 27,000 other viewers to mail in 50 cents each for a syllabus, and it attracts an estimated 270,000 regular viewers of all ages and walks of life.

Professor White, commands a television following whose eagerness and tenacity could be the envy of Perry Como. Apart from thousands of college students and gifted high-school students, those who rise with the dawn to attend his class number housewives and GIs, priests and prisoners, technicians, engineers and the physically handicapped.

In the San Francisco Bay area alone, more than 800 professional engineers are watching the program as a refresher and a means of bringing themselves up to date on the latest discoveries and theories.

BLIND STUDENTS

In Muskogee, Okla., and Stamford, Conn., blind high students listen to Dr White, then work out his assignments with the help of others. San Quentin Penitentiary is making the course available to qualified inmates, and all over the country industrial companies have paid registration fees for employees taking the course for credit. Inquiries about extending the program beyond the continental U.S. have come from Peru, Samoa and Puerto Rico (where a kinescoped version of the course is already carried on two stations.)

Dr White, professor of physics at the University of California in Berkeley, is currently on leave for his TV assignment. He is also a consultant to the Atomic Energy Commission.

Occasionally, he presents as guest lecturers such distinguished colleagues as Willy Ley, the rocket and space-travel specialist; M.I.T.'s Dr George R. Harrison, who dealt with "Diffraction Gratings," and Stanford's Dr Paul Kilpatrick, who taught "Ballistics."

Dr White's guest roster will include seven Nobel Prize-winning authorities in the field.

His program is recorded on video tape in N.B.C.'s Manhattan studios in the R.C.A. Building. Dr White's lecture is taped (and simultaneously kinescoped for some stations) late in the afternoon in a single half-hour session. It has never been retaped or edited, so its live quality is kept intact

In order to visualize a basic physical law, Dr White uses an electric 'rain in his lecture on "accelerated motion".

Dr Vernon E. Eaton, of Wesleyan University, one of "Continental Classroom's" guest lecturers, demonstrates "prolonged light" before the television camera.

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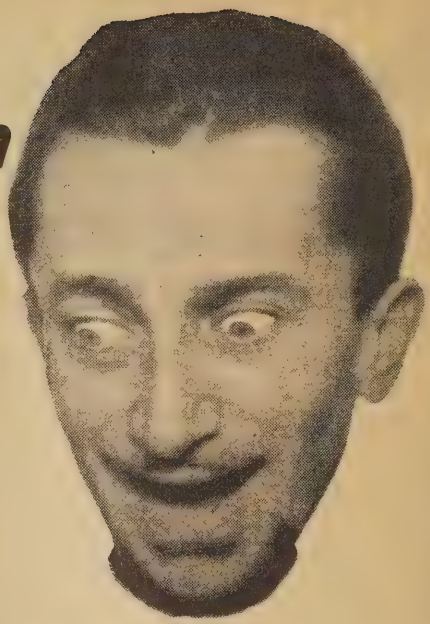

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A CONTRAST IN USE OF POWER

The wide range of power requirements for this modern age is strikingly illustrated by these two items, each a news story in itself. The contrast is even greater when we remember that one organisation produced them both. The pattern is repeated many times in industry.

THE General Electric Company has demonstrated what is believed to be the world's first battery-powered personal portable TV set. Completely transistorised, the Lilliputian weighs 10 pounds and is about the size of an automatic toaster. The set can be operated from house current as well as from its battery.

The tiny receiver is a developmental model and, as yet, is not ready for consumer introduction. However, it is fully operative and provides selectivity equal to a full size TV set.

The present cost of transistors prohibits marketing such a set at an acceptable consumer price.

The personal portable TV set is 7 1/4 inches wide, 7 1/4 inches deep and 8 3/4 inches high. The case is covered in vinyl plastic and is equipped with a carrying strap.

The chassis used in the set has 22 transistors and an 8 inch diagonaol measurement picture tube. Power is supplied by a rechargeable silver cadmium battery with power consumption of 7 1/2 watts and a life of from three to four hours before recharging. The set can be recharged as it is being used on house current.

Developmental personal TV completely transistorised.

PROJECT No. 2

Two-part G.E. proposal to make nuclear power stations competitive with conventional power plants by 1965 includes accelerated development of boiling water reactor plants.

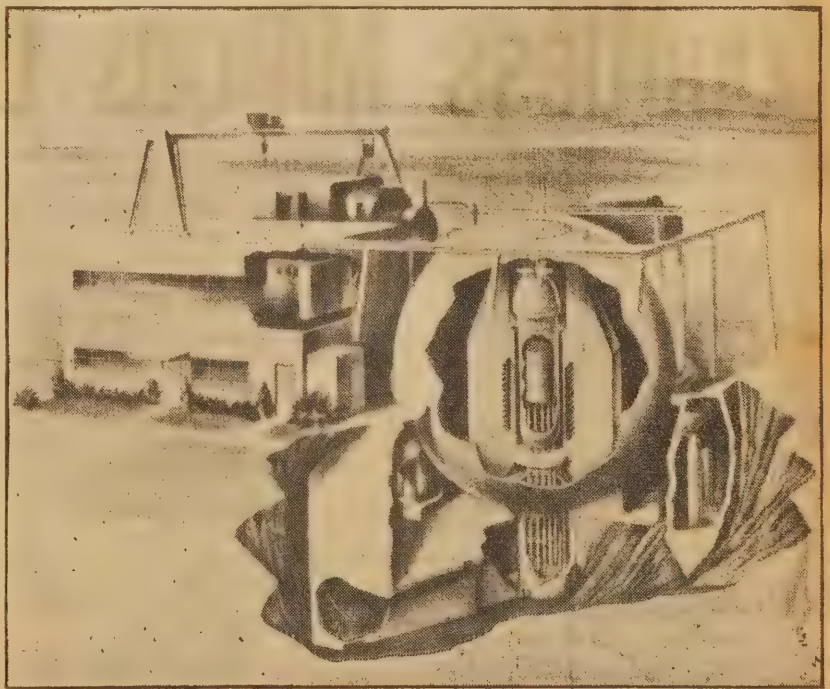
Under this plan, package plants would be mass produced so that utilities across the country could obtain operating experience and atomic power could be introduced to the public on a broad scale.

Mass production of up to 50 such plants would be accomplished under the "Operation Knowhow" half of the proposal.

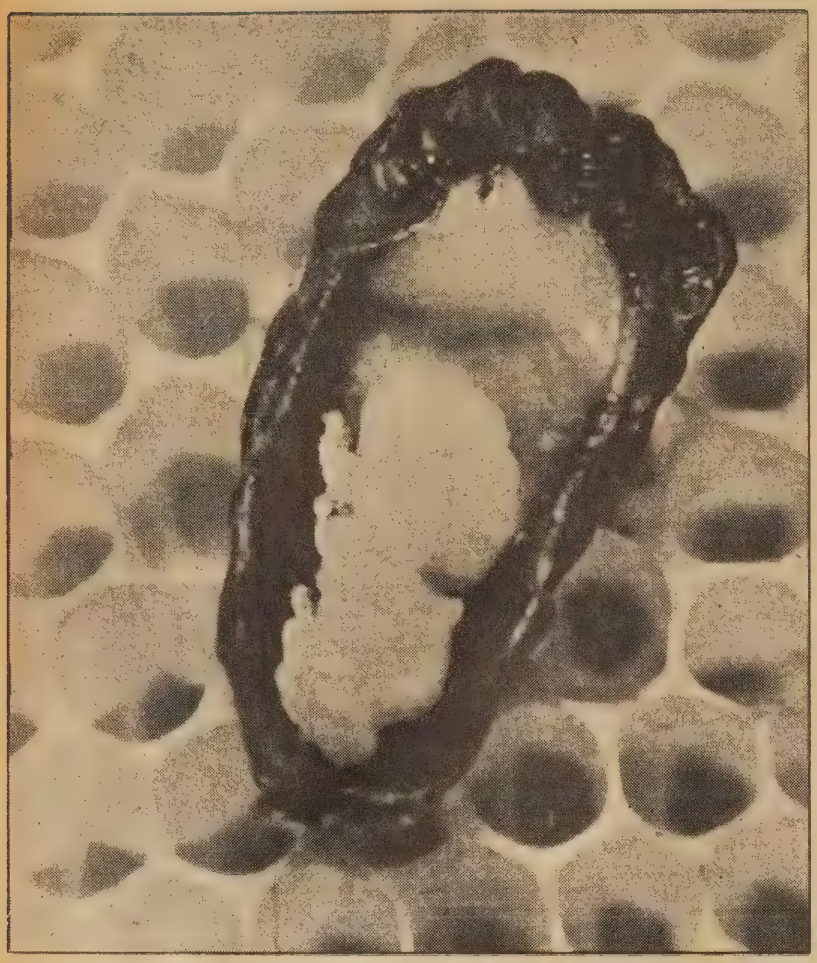
"Operation Sunrise," the other half of the program, calls for completion by 1962 of five developmental nuclear power plants, followed in 1965 by three evolutionary plants that would compete with conventional power plants in higher fuel cost areas of this country.

By 1970, "target" plants producing power for six and one-half mills a kilowatt hour should be in operation and will be competitive with 25 per cent of fossil fuel plants being installed at the time.

All of these plants will be of the boiling water reactor type. Many will use the familiar spherical reactor enclosure In this plant, the turbine-generator is installed on top of the building at left, with plant controls and office space inside the building.



A nuclear packaged power plant soon to be ready.



An unborn queen bee in her cell, larger than normal. She eats "royal jelly", a special food produced by the workers for queens only

Countless Millions Of Insects

It would be impossible even to estimate the number of insects in the world. Left to themselves they could over-run the universe. But when we examine their social lives some staggering facts come to light.

by Calvin Walters

NUMERICALLY speaking, the insects are the largest class of creatures in existence.

Most people will be ready to believe this with no more proof than trying to enjoy the evening coolness in a garden or on a patio on a hot summer's night.

On such occasions one is invariably attacked with myriads of all kinds of insects and only insects. It is noteworthy that one is never attacked by cows, horses, poultry or dogs unless one is unlawfully in the wrong garden when a dog or even the owner might become somewhat aggressive.

Yes, it is always insects which settle in your hair, fight in your ears or crawl up the leg of your pants.

Notwithstanding the great discomfort they cause, insects continue to arrest the attention of entomologists because there is so much which even today is unknown about this class of creature.

That which is known makes a story which is not only fantastic but in many cases unbelievable were it not for the evidence of people of recognised integrity.

Few people have the time to spend hours on their stomachs watching the behaviour of insects through a magnifying glass, or engaging in such diversions as painting one eye of a fly black to see what happens or removing one half of the brain of a flea or kidding insects off their courses with different coloured lights and so on.

It is only by such means that anything can be found out about insects and such methods in recent years have produced some remarkable findings.

The number of species of insects in existence has been estimated at well over a million and they are being added to every day.

So prolific are insects in the reproduction of themselves that the number of progeny of a pair of insects can run into astronomical figures in a single year.

FLIES GALORE

It has been estimated that if all the females of a house fly survived, the possible number of progeny from a pair of flies in a year would be six thousand billion.

The most prolific of all insects is the aphid, commonly found eating the roses in the garden.

These insects can produce thirteen generations in a year. Strangely enough, all descendants are females and if all these females were allowed to multiply unhindered then the number of progeny from a single female in one year would amount to the fantastic figure represented by one followed by 108 noughts.

Professor Herrick worked it all out to say that, as one aphid weighs about one milligram, and if all the progeny survived, the total weight at the end of a season would be some 800 million tons.

Fortunately for us, all the progeny do not survive owing to the inroads on their population made by enemies, accidents and the gardener's spray.

There is practically no substance on which some sort of insect does not feed so that everything is vulnerable to their inroads. Even poisons are subject to the attacks of insects.

There is a small beetle called Niptus Hololeucus, which is almost indestructible. These have been found in the corks of cyanide bottles in the laboratories of entomologists. They eat and thrive on cayenne pepper and sal ammoniac. They have been found in great numbers in a bottle of casein, which had been corked up for about 12 years.

REALLY TOUGH!

A famous entomologist, Dr Thorpe, has drawn attention to a fly called Psilopa petrolei, which can not only live for indefinite periods in cedar wood oil but can resist for long periods the action of alcoholic picro-formol and live and thrive in crude petroleum.

Another fly of this species continues to prosper in strong solutions of borax

MONARCH BUTTERFLY ESCAPES FROM ITS CHRYSALIS

A monarch butterfly cracks open its chrysalis in preparation for its final stage of maturity

Here the young butterfly crawls out of the chrysalis and hangs downward while it frees its legs

Legs now free, the young butterfly climbs back over the chrysalis to achieve a vertical position

and in hot springs and strongly alkaline lakes.

Some insects are rather particular about what they eat. Others, as mentioned above, are not so particular.

One of the particular kind is the termite. He eats nothing but cellulose—that most indigestible content of wood. The peculiar thing about it is that the termite cannot digest the stuff himself. He keeps a number of protozoa inside himself and it is these creatures which do all the digesting.

Cockroaches will tackle meat, vegetables, paste and other cockroaches. Midges cannot eat at all while other insects must get inside other insects in order to eat, live and multiply.

SOCIAL SYSTEMS

Many insects live under highly organised social systems. These are found on all social levels from those similar to tribal clans to those who specialise in different occupations, from the keeping of pets, cultivation of gardens, the organisation of armies and the building of cities.

As Dr Malcolm Burr puts it, some insects have developed a social life upon a system so rigid that, by comparison, Karl Marx was a die-hard Tory.

He points out that termites erect citadels 20 feet high notwithstanding that the termite is soft, blind and individually defenceless. These insects invented the arch and will dig a well 50 feet deep to get water for the colony.

An interesting scientific point is raised by the question, "Why does a fly annoy a person who is moist with perspiration." Also, why do not insects land on the water when they want a drink. It will be noticed that flies and other insects always prefer wet surfaces to drink from.

WEIGHT WHEN WET

The answer lies in the ratio between weight of water and surface area of body for a given individual. Dr Malcolm Burr points out that when a man steps from a bath he has about one pound of water on his body. A wet mouse carries his own weight of water, but a wet fly carries many times his own weight.

Thus an insect, unless he is specially built for the purpose, always risks drowning if he lands on water for a drink, because if he breaks the surface tension and gets wet he will invariably sink.

Some insects of course walk on the water but these are the ones built for the purpose. They walk so lightly as not to break the surface tension.

Professor Haldane has shown why the force of gravity presents no problem to an insect. By dividing the length, breadth and height of a body by ten the weight is reduced to one thousandth

The butterfly clings firmly to the chrysalis shell while its wings expand and harden ready for flight.

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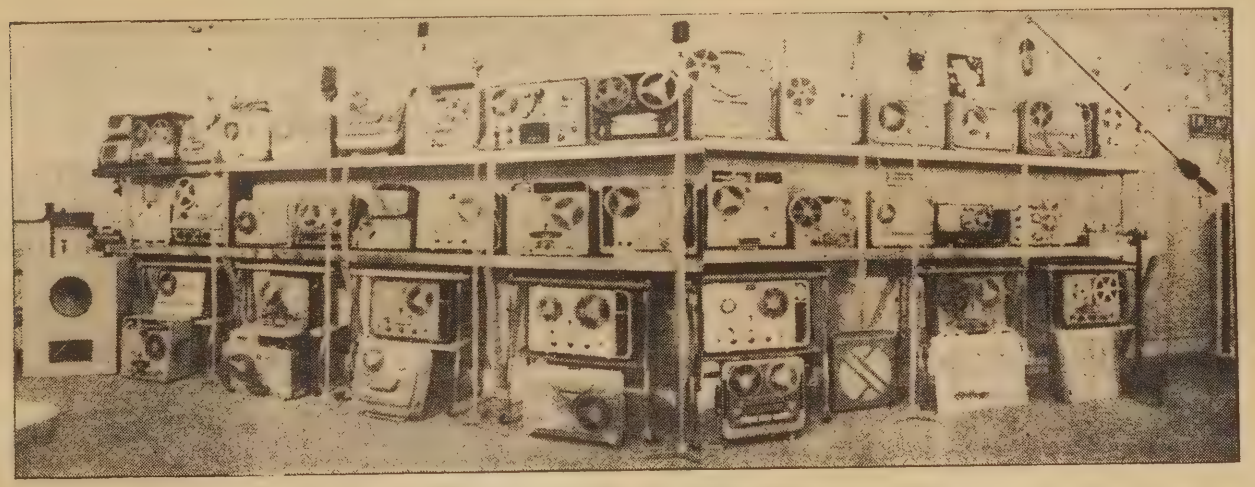

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AN ANT'S WINDOW ON THE WORLD

A close-up of the compound eye of a worker Red Wood ant.

but the surface is reduced to only one-hundredth. Thus the resistance to falling (area) is ten times greater than the driving force and so the little insect can remain aloft without difficulty.

Considerable research has gone into the flight of insects and some curious facts brought to light.

One often hears the statement that if a man could jump like a flea he would be able to cover 300 yards in one hop.

Our old friend Professor Haldane has again come to the rescue and pointed out that the energy required in the act of leaping is proportional to the weight of the jumper and that the height to which an animal can jump is more nearly independent of its size than proportional to it.

THIS JUMPING BUSINESS

A curious fact was brought to light by Dr George P. Bidder when he pointed out that the maximum height to which the larger animals can jump is remarkably constant.

Horses, cats, dogs and men can jump to a height of about six feet. But a flea can jump about 8 inches. At first thought this sounds pretty good for such a small creature and leads to the erroneous conclusion that a man should be able to jump the 300 yards mentioned earlier.

A man can jump approximately ten times as high as the flea, but his body is eight hundred times as long. If we assume that it is only size that counts then a man should be able to jump 800 times as high as a flea. But the energy required is proportional to the weight of the jumper and a man just hasn't got the energy to jump 800 times higher than a flea.

Unlike the flying birds and mammals an insect requires little force to keep himself in the air because he does not have to worry much about the force of gravity as mentioned previously.

Nevertheless insect flight is a complex action which has been studied under extraordinarily painstaking circumstances.

WING MOTION

For instance it had been extremely difficult to determine the true motion of an insect's wings until Marey of France hit upon a brilliant idea in 1868. Marey attached a small piece of gold leaf to the wing tips of a wasp. The wasp was held on a stationary fixture set in the light against a dark screen. The wasp naturally attempted to escape by flying and in doing so the trajectory of the wings became clearly visible by the gold leaf glittering in the sun in the form of a figure eight.

To find out which direction the wings were beating during flight Marey introduced thin glass plates blackened with soot into the trajectory and noted the side from which the soot was brushed by the wing.

In another experiment Marey fixed the frantic wasp inside a revolving paper cylinder the walls of which were blackened with soot. The direction of the wing beats were perfectly outlined on the black surface Later experimenters carried out the same experiment but went further by flattening the blackened paper with its curves, comparing them with similar curves made by vibrating tuning forks.

These forks, of course, were of known frequencies. Such a comparison showed that a dragon fly makes 20 strokes per second, a bee makes 200, a butterfly 9. The top speed recorded was a species of fly with a beat of 330 per second.

Most insects have two pairs of wings, one large pair and one small pair attached to the rear of the larger. The house fly has to be different, of course. It has only one pair of wings and, in place of the smaller wings at the rear, it is provided with small protruberances called halteres.

It has been only in the past few years that anyone has taken the trouble to investigate these halteres scientifically.

It has been shown that the shape of a common fly is not the best for flying and, therefore, it had to be provided with something with which to maintain its equilibrium in flight. This something is the dumbbell-shaped halteres.

KIND OF GYROSCOPE

It is now thought that the halteres are really some form of biological gyroscope arranged in such a way that the fly can gain some indication of its rotation in the yawing plane, and by the nervous impulses in the halteres it knows when to turn to the right or left.

Unlike the pilot of an aeroplane, however, the fly cannot differentiate between a pitching or rolling movement.

Quite an amount of the principles of aerodynamics are involved in the matter and the fly even seems to be able to follow them instinctively.

The fly becomes spirally unstable if the halteres are removed and it falls to the ground. If the force produced by the wing on one side is any greater than the other the fly will go into yawing movement culminating in a spin unless it is corrected. This is done by means of the haltere, just as it is corrected in an aeroplane by adding a fixed fin to the tail.

FIGURE-8 MOVEMENT

In the figure 8 movement of insects the pattern has been interpreted as showing that the insect is lifted and propelled by the downward and forward stroke.

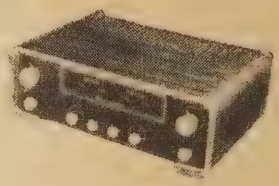
The wing then moves upward and backward in a manner similar to the feathering of an oar. Thus the resistance to the air is at a minimum during the upward and backward stroke. At the end of this stroke the wing has recovered ready for the forward and downward stroke once more. The whole wing cycle draws the air from above and ahead and then pushes it below and behind.

Very often an insect will be seen fluttering its wings before it takes off into the air. This is specially true of the larger ones.

(Continued on Page 123)

STEREO

HAS ARRIVED!



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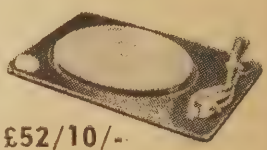

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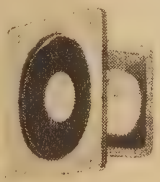

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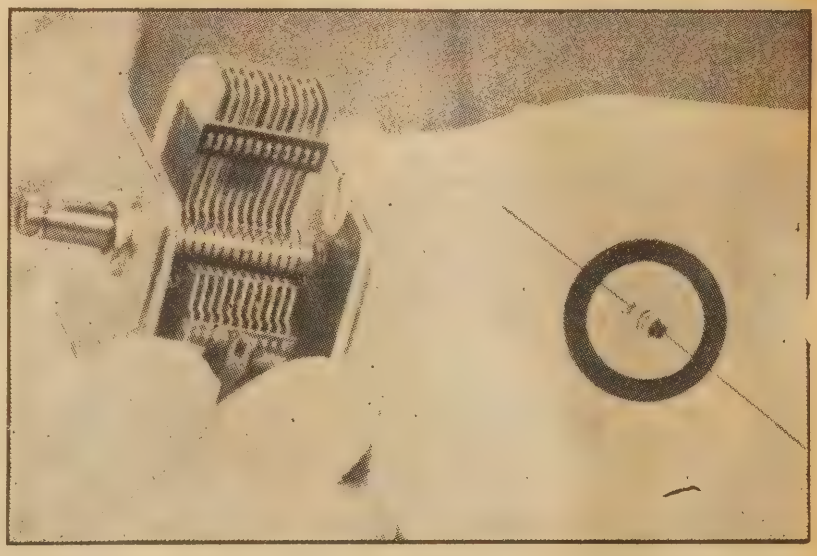
Technical Review

SEMI-CONDUCTOR VARIABLE CAPACITORS

This interesting article, extracted from Radio and TV News, describes how a change in voltage applied to a suitable transistor can be used to produce changes in effective circuit capacitance.

By H. R. SMITH



Varicap is compared with ordinary tuning capacitor.

DID you ever think of a germanium or silicon diode as a variable capacitor? Probably not—but it can be and a good one at that! In a properly constructed diode, the capacitance can be varied over fairly wide limits by merely varying the voltage across it.

To understand how this can be, let's briefly examine the basic structure of a typical junction diode. This structure is indicated in Fig. 1, where you can see that it consists essentially of a junction between p-type and n-type silicon or germanium.

SEMI-CONDUCTOR TYPES

We should perhaps pause here a moment to discuss what is meant by p-type and n-type material. Absolutely pure semiconductor material is completely neutral, that is, it has neither an excess nor a deficiency of electrons in its crystalline structure. However, if we add a very minute amount of an impurity, such as arsenic, we can introduce an excess of electrons, leading to n-type material. By introducing a different impurity, such as gallium, we can rob the material of some electrons, leaving positively charged "holes," a characteristic of the p-type material.

Now that we have n-type and p-type material, we form our p-n junction by placing these two materials next to each other. This can be done in several different ways. A technique developed at Bell Telephone Laboratories, called diffusion, is an excellent way of doing it. We start with n-type material and diffuse into it a small amount of p-type impurity thus forming the desired p-n junction.

Here we have the basic elements of a capacitor—two conductors (the p-type and n-type material) separated by an insulator. The neutral layer between the p-type and n-type material serves as the insulator. Thus we have a diode capacitor.

Now let's see what happens if we apply a voltage to this diode. We can see immediately that the effects of this voltage will depend on its polarity, so let's first connect the positive terminal to the p-type material and the negative terminal to the n-type. The electrons in the n-region will be repelled over into the p-region and the positive holes will tend to move from the p-region to the n-region. Thus we have all the conditions for a flow of current and this is exactly what takes place. We say that the diode is "forward-biased" and will pass current.

REVERSED VOLTAGE

If we reverse the voltage on the diode, the positive voltage tends to attract the electrons in the n-region, keeping them from moving over into the p-region. Also, the negative voltage attracts the positive holes, preventing them from moving across into the n-region. Therefore, we will have no flow of current. Furthermore, the applied voltage will produce a region between the two layers where no charge exists and the higher the voltage the thicker this no-charge region. We call this the "reverse-bias" condition for the diode. This is shown schematically in Figs. 2B and 2C.

We know that the actual capacitance of a capacitor depends inversely on the thickness of the dielectric between the two conducting plates, all other things being equal; that is, the thicker the dielectric, the less the capacity. Thus, we have here in our reverse-biased diode all of the conditions for a variable capacitor. At zero bias, we have minimum thickness of the centre layer and thus maximum capacity. As the reverse bias is increased, the thickness of this centre layer increases and the capacity decreases up to the point where the reverse voltage is sufficient to cause breakdown.

This explanation is perhaps somewhat oversimplified and ignores many factors which should be taken into consideration; however, it does give a reasonably accurate picture of the conditions in a reverse-biased diode capacitor.

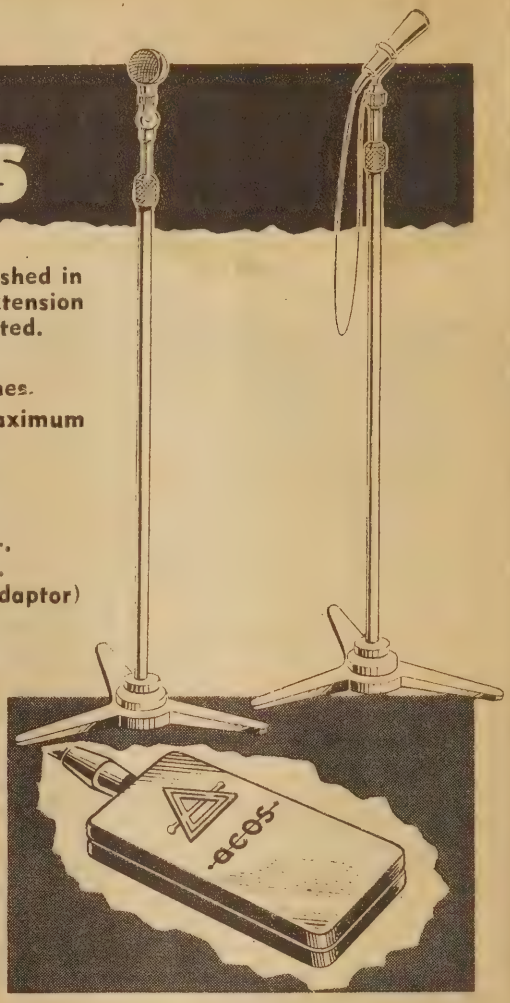
AVAILABLE IN U.S.A.

Semiconductor capacitors are available from at least two companies. Pacific Semiconductors, Inc., uses the trade-name "Varicap" for its alloy junction silicon units, while International Rectifier Corp. has selected the trade-name "Semicap." If you are interested in experimenting with this new component, representative units are available on the open market.

With a new component of this nature, a problem arises as to the best means of indicating it on a schematic diagram. Pacific Semiconductors has selected the representation shown in Fig. 3. It is

acos

microphone FLOOR STANDS



Two new Floor type Microphone Stands are now available for use with Acos Microphones—

Model "A" for use with type MIC 16 Microphone. The top of the extension arm is threaded to take MIC 16 Microphone.

Model "B" for use with MIC 39. The extension arm has a special adaptor to take the MIC 39 Microphone. The base and lower tube are finished in silver varitone, the extension arm being chrome plated.

Dimensions:—

Base diameter: 17 inches.

Height: Min. 3' 3", maximum 5' 6".

Weight: 11 pounds.

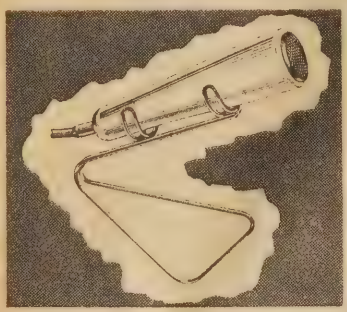
Prices:—

Model "A" £5/6/-.

Model "B" £7/-/-.

(includes MIC 39 adaptor)

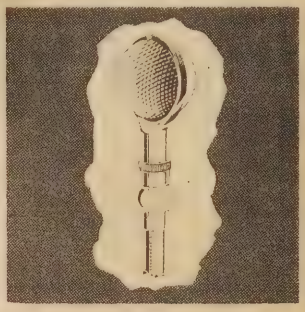
COMPANION MICROPHONES



CRYSTAL STICK MICROPHONE, MIC 39-1

The MIC 39-1 has been beautifully styled as a hand, desk stand or floor stand unit, and precision engineered to the highest professional standards. A heavy die-cast liner in the microphone case eliminates the possibility of hum pick-up due to hand capacity effects. The use of a special noise-free cable improves screening and gives a greatly increased signal-to-noise ratio.

Designed especially for high quality recording, broadcasting and public address work. PRICE £8/19/6, complete with desk stand.



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Incorporates the world-famous floating crystal sound cell construction Its fine performance is not affected by vibration or shock, and the fidelity is not impaired by low-frequency noise. This microphone has been designed to satisfy the most exacting requirements of Acoustic measurements, Industrial noise measurement, Disc Recording technique, and Public Address systems, etc. PRICE £24/19/6

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The VP 1 Vibro-Voice has been specially designed for use with guitars double bass and in fact all stringed instruments With the use of this simple yet effective pick-up together with a good quality amplifier any instrument can be amplified.

The VP 1 has an ample output and a frequency range which extends to approx 5 K/cs. The tough rubber case protects the instruments from damage. Easily connected to the P.U. input of your amplifier or radio with a resistance of 5 megohms in series with the inner core of the cable

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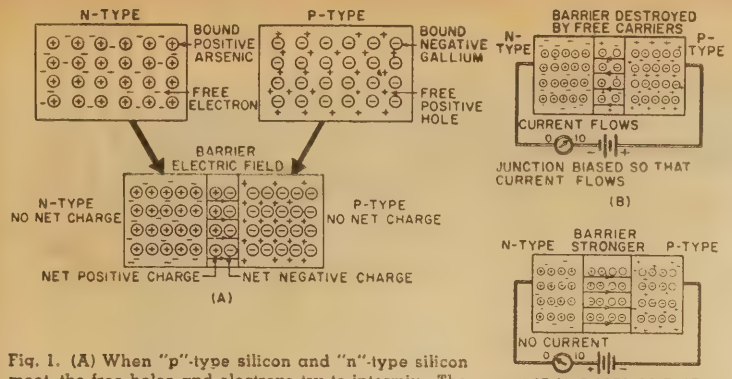


Fig. 1. (A) When "p"-type silicon and "n"-type silicon meet, the free holes and electrons try to intermix. The holes which enter the "n"-type material disappear and leave behind negatively charged gallium atoms, and the electrons which enter the "p"-type material disappear and leave behind positively charged arsenic atoms. These fixed charges constitute an electrical barrier which prevents the rest of the holes in the "p-"side and electrons in the "n"-side from intermixing. (B) This barrier is responsible for the rectifying properties of "p-n" junctions. If a voltage is applied across the junction in a way such that the natural barrier field is overcome by the applied voltage, then holes are encouraged to flow into the "n"-side, and electrons are encouraged to flow into the "p" side. (C) If a voltage is applied across the junction in a way such that the natural barrier field is re-inforced, the holes are more firmly captured in the "p"-side and the electrons in the "n"-side. No free charge can cross the barrier; therefore, no current will flow. Courtesy of the Bell Telephone Laboratories.

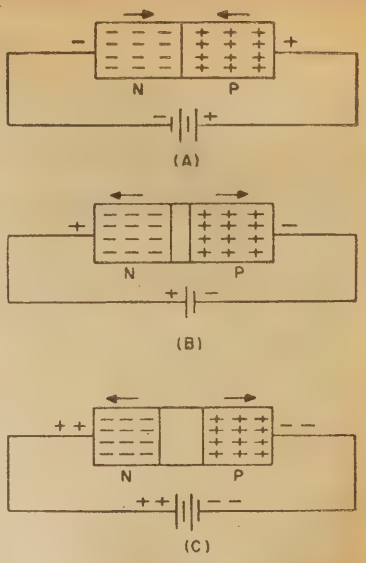


Fig. 2. Situation existing in a diode under various bias conditions. (A) Forward bias. (B) small reverse bias, and (C) large reverse bias conditions are illustrated.

a composite representation and includes the two plates for a capacitor, an arrow to indicate variability, and the conventional diode symbol in the background. We will stick to this representation in the diagrams presented here.

FIGURES OF MERIT

What sort of capacitance and "Q" (figure of merit) values are available with this new component? Fig. 4 shows the variation of capacity vs. voltage for a typical "Semicap." As can be seen, the capacity ranges from about 38 uufd. down to 3 uufd., a very useful variation for many applications. The "Q," as indicated in Fig. 5, is well over 1,000 at one megacycle, which is as good as that of many fixed capacitors. The "Q" decreases with frequency, as can be expected, but the units may be used up to 500 mc. in applications where high "Q" is not required. The "Q" can be effectively increased by placing a high-quality fixed capacitor in series with the diode.

"Varicaps" are available with capacitance values of 20 to 56 uufd. at —4 volts bias. Total variation available is better than 4-to-1 within the voltage ratings. Maximum permissible voltage on most units is around —20 volts.

Continued efforts are being made to increase the "Q" by decreasing the effective series resistance. For example, scientists at Bell Telephone Laboratories are working on an experimental diffused-base silicon diode which is useful at frequencies well up into the thousands of megacycles. This unit has an active diameter of about .002 inch and incorporates a special construction to minimise inductance and capacitance of the attached contacts. Series resistance is extremely low, with the result that "Q" is high

USE OF CAPACITORS

Now that we have this variable capacitor, what is it good for? Pacific Semiconductors lists sixteen potential applications and implies that others will undoubtedly come to mind as engineers and scientists continue their exploratory work

Probably the most logical application is that of voltage tuning, as shown in Fig. 6. Here the capacitor is a part of the tuned circuit and is isolated from it for d.c. purposes by a large blocking capacitor. Z is a choke to prevent r.f. from feeding back into the bias source. Tuning is accomplished by varying the potentiometer setting, thus varying the voltage across the diode capacitor. If this voltage were derived from a suitable control circuit, such an arrangement could be used for automatic frequency control in AM or FM receivers.

IN MODULATION

If the d.c. control voltage is replaced by an a.c. source, we have a ready means of obtaining frequency modulation. A circuit proposed by Pacific Semiconductors for this purpose is shown in Fig. 7. Such an arrangement could be used in ham transmitters, signal generators, and the like. In this circuit R1 is a load for the audio signal and C2 is an r.f. bypass capacitor. R2 is the r.f. isolation resistor (or r.f. choke), C4 the d.c. blocking capacitor, L1-C3 the oscillator tank circuit, and C1 the "Varicap," which is effectively across the tank circuit. The centre frequency of the oscillator may be controlled by varying the d.c. bias through R2. Signal voltage across R1 varies the bias on the "Varicap," changing its capa-

(Continued on Page 27)

Fig. 3. Development of "Varicap" symbol.

Fig. 4. Capacity vs bias for "Semicap." Courtesy of International Rect. Corp.

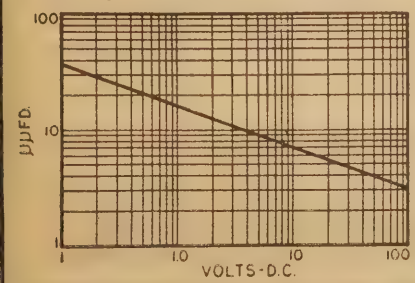
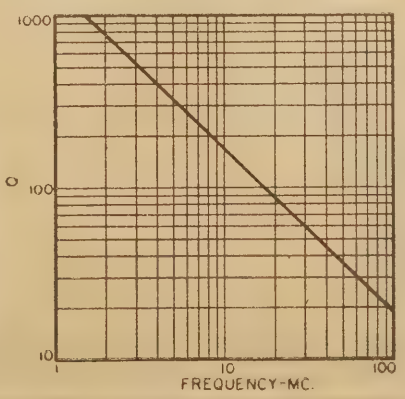


Fig. 5. "Semicap" "Q" versus frequency. Courtesy of International Rect. Corp.



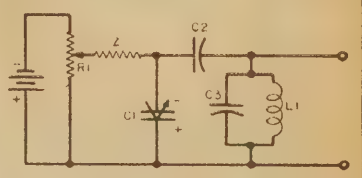
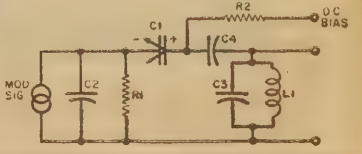
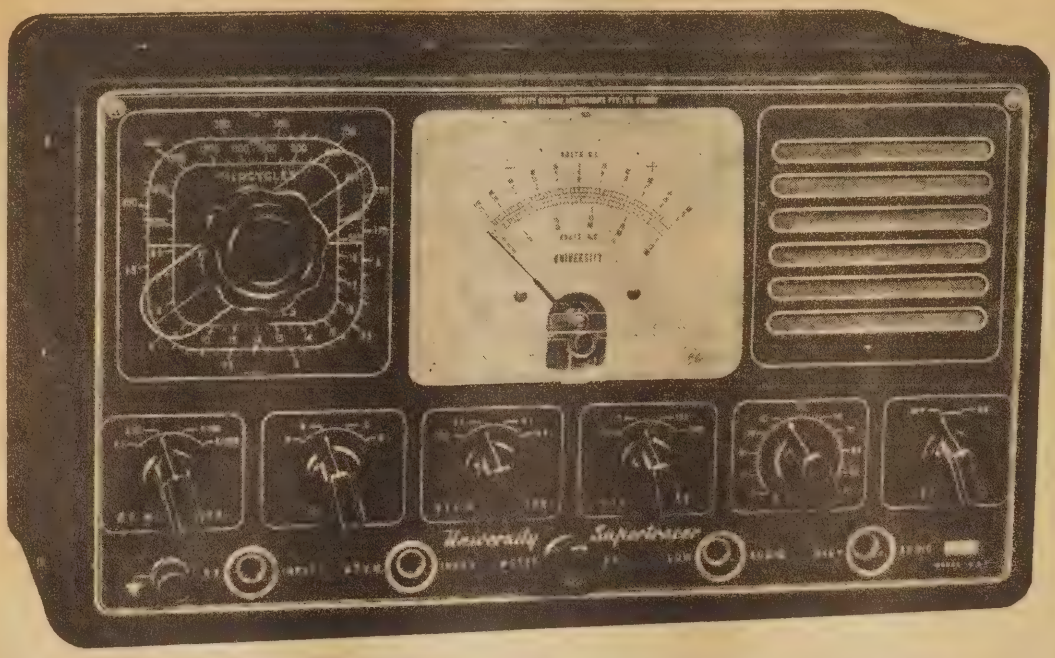


Fig. 6. Voltage tuning by means of a variable capacitor unit. Refer to text. Courtesy of Pacific Semiconductors, Inc.

Fig. 7. Circuit for providing FM signal. Courtesy of Pacific Semiconductors, Inc.





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Signal Tracing has long been recognised as the most efficient means for locating faults in radio receivers, audio amplifiers and similar equipment. University Instruments have produced something more than a Signal Tracer. It is a sensitive Signal Tracer combined with a Vacuum Tube Voltmeter which opens up a wide range of possibilities and brings fault finding in service work to a stage where faults can be quickly located and analysed ready for speedy repair.

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SOLID - STATE PANELS FOR DISPLAY OR STORAGE

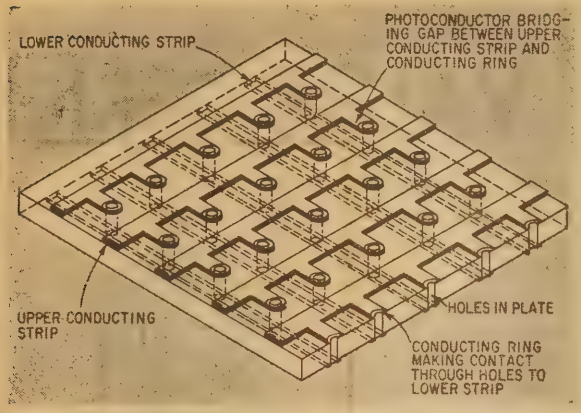

LOWER CONDUCTING STRIP
PHOTOCONDUCTOR BRIDGING GAP BETWEEN UPPER CONDUCTING STRIP AND CONDUCTING RING
HOLES IN PLATE
UPPER CONDUCTING STRIP
CONDUCTING RING MAKING CONTACT THROUGH HOLES TO LOWER STRIP

FIG. 4—Cross-grid panel employing photoconductors.

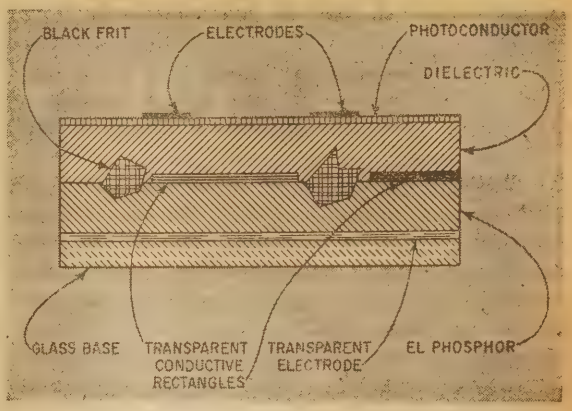


FIG. 5—Cross-section of combination display screen.

Solid-state devices continue making inroads in the area of display and/or storage panels. A cadmium-sulfide photorectifier panel array shows promise for storage, picture quantizing, reading and character recognition. Electroluminescent panels with photoconductive control are outlined—"Electronics."

PANEL-DISPLAY and panel-storage devices are receiving considerable attention for such applications as TV screens, computer storage and amplifying X-ray panels. Among the many variations under investigation are the following: crossed grid electroluminescent panel; persistent-emission displays combining both electroluminescent and photoconductive layers; ferro-electric displayers using a variable capacitor as a control element; electroluminescent feedback storage; fibre optics and gas photorectifier arrays.

PHOTORECTIFIER ARRAY

Under joint Army, Navy and Air Force support, a so-called photorectifier has been developed. A transparent ohmic contact was applied to one surface of a sintered CdS cell and a rectifying contact to the opposite surface.

The resulting photorectifier acts as a diode with a rectification ratio of about 1,000 when the transparent conductor is exposed to illumination. In the dark, the photorectifier (unlike a photodiode) is an open circuit or, more precisely, a linear resistance with a value of hundreds of megohms.

Arrays of the photorectifiers can be constructed in an X-Y matrix fashion with packing densities of more than 256 per sq. in.

Logical networks for computers can be connected by selecting the required photorectifiers in an array with an appropriate light mask.

The only action necessary to change the network is to change the mask. This flexibility eliminates the need for soldering diodes into the array. A punch-card or a photographic negative can be used as the mask.

If a single photorectifier cell is four mils thick, its spectral response peaks at about 6,700 A. It takes about 100 millisec for the photorectifier to go from the high-impedance state to the diode state. Response as a diode is less than a u/sec, permitting fast switching. Illuminated, forward impedance is 10,000 to 20,000 ohms at 10v.

Figure 1 shows a portion of an actual array of 10 cells per in and a total of 1,224 cells. Various stages of development are illustrated: the diced photorectifier on the transparent conducting strips; with the filler added; with the top conductor applied and with the top coating of epoxy resin applied to protect the cells from moisture.

CONTROL MATRIX

Figure 2 illustrates how a photorectifier array can be used as a control matrix for a character generator. The electroluminescent panel is driven at 1,000v peak-to-peak by ferrite switch cores used as saturable transformers. Since the cores are square-loop ferrites, they select as well as drive. The three-stage program counter provides a sequential line scan in the X-direction. The Y drivers are controlled independently with their control functions generated by the photorectifier array.

OTHER APPLICATIONS

Application of the array as a fixed or semi-fixed storage device might be as function tables where the function can be changed (sine to tangent, for example) by changing the mask. Another application of this type would be as a fixed program storage in a computer.

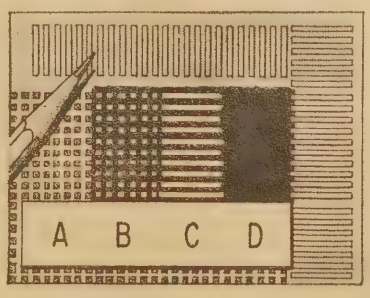


FIG. 1—Photorectifier array construction techniques.

Still another application would be any situation where a stationary or slowly changing light pattern has to be scanned and converted into a train of electrical pulses. Typical specific uses in this area would be picture quantising, page reading, character recognition and film data processing.

In a discussion of pickup panel displays combining electroluminescence and photoconductivity, different modes of operation of such devices were described.

The pickup panel as the term is used here is a device in which the light sum of light level radiated in a definite time interval is increased over the light sum of light level incident on the panel in the same or prior time interval. It is, therefore, different from the so-called light amplifier.

Figure 3 shows a typical crossed-grid electroluminescent panel. Figure 4 illustrates a similar device using photoconductors.

Both electroluminescence and photoconductivity are combined in the display screen shown in Fig. 5. This panel may be operated in two modes. In the first mode, for long-duration storage, the photoconductor acts partially as the plate of a capacitor in series with the electroluminescent layer.

In the second mode, volume conductivity is used for photoconductor operation by replacing the dielectric shown in Fig 5 with photoconductive material. In this type of application, controlled persistence is obtained. Primary usage for such a device is to replace long-persistence screens in cathode-ray tubes.

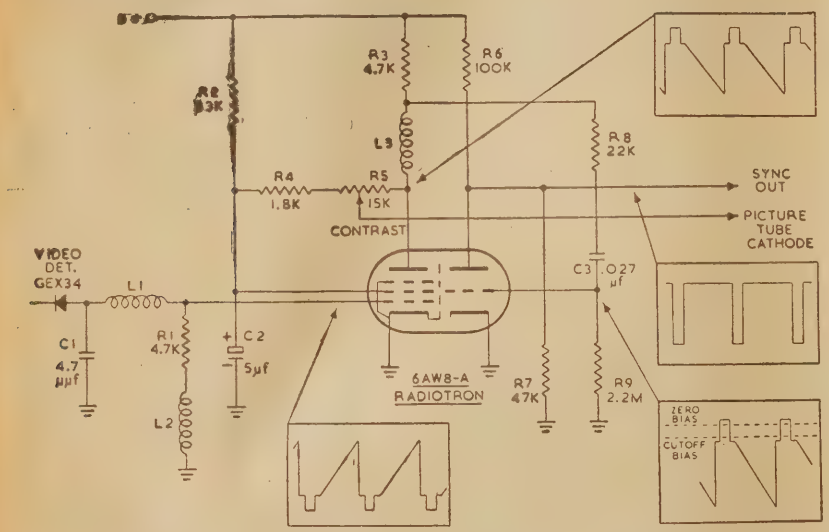
MEDIUM LIGHT LEVELS

For medium-light-level displays with storage, the conducting rectangles shown in Fig. 5 are omitted. On the top surface of the glass dielectric, the thin photoconductive layer makes contact with the top electrode. Because of feedback, the glass dielectric is transparent and extremely thin. When pulsed with a light sum of about 0.3 ft-candle-sec, the photoconductive layer becomes highly conducting. It remains so during an interval of the order of the decay con-

RADIOTRON

TELEVISION VALVE SERIES

The Radiotron 6AW8-A is a 9-pin miniature high-mu triode, sharp-cutoff pentode designed for service in television receivers. Although the triode section is primarily intended for use as a sync clipper, it can also be used in other functions such as sync amplification, sync "splitting" or audio amplification. The pentode section is intended for use as video amplifier, and features high transconductance at low plate current, sharp-knee plate characteristics, and low inter-electrode capacitances. These features give a video amplifier a high figure-of-merit and make it capable of large voltage output. The output of the 6AW8-A video amplifier provides direct drive for conventional picture tubes.



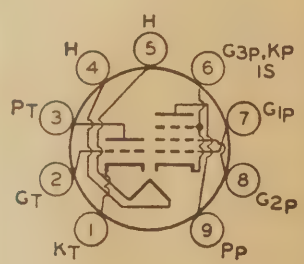
Simplified Circuit Showing Typical Application of the 6AW8-A.

In the typical circuit shown above, the negative-going composite video output from a conventional video detector is applied to the control grid of the pentode. The amplified positive-going signal across the pentode plate load, R3 and L3, is applied to the cathode of the picture tube via a suitable potentiometer arrangement which serves as a contrast control. L3 is the plate peaking coil.

The positive-going composite video signal is also applied to the grid of the triode. Grid current during the sync tips charges C3. Between sync pulses, C3 loses a very small amount of its charge through R5. Thus the sync tips are "clamped" at approximately zero grid potential. R6 and R7 form a divider to supply the triode with a suitable plate voltage. Plate-current cutoff ensures that the clamping level of the composite video signal at the grid is below control grid cutoff. Thus the triode plate current is derived from the sync pulses only. The amplified negative-going sync signal appears across the triode plate load, R6 and R7, and can be applied to a sync amplifier or splitter.

6AW8-A

SOCKET CONNECTIONS
bottom view



PIN 1: TRIODE CATHODE
PIN 2: TRIODE GRID
PIN 3: TRIODE PLATE
PIN 4: HEATER
PIN 5: HEATER
PIN 6: PENTODE CATHODE, GRID No. 3, & INTERNAL SHIELD
PIN 7: PENTODE GRID No. 1
PIN 8: PENTODE GRID No. 2
PIN 9: PENTODE PLATE

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stant of about 150 millisec. In this period, the displacement current through the glass dielectric is sufficient to bring the electroluminescent panel associated with it up into the 12 ft-candle brightness state.

LOW LIGHT LEVELS

In the low ambient state with the photoconductor in the insulating condition, the displacement current is carried partly by the parasitic capacitance across the glass dielectric from the top electrode.

To maintain the light sum needed to trigger on the display at a suitable value (0.3 ft-candle-sec), resistance of the photoconductive layer cannot be allowed to rise into a truly insulating condition

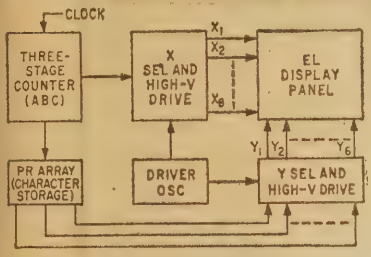


FIG. 2—Block diagram of system using photorectifier array and electroluminescent display panel for a character generator

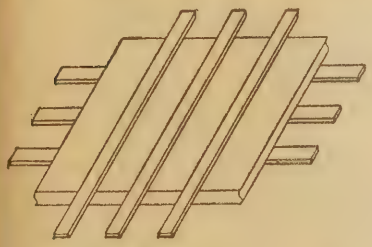


FIG. 3—Portion of a cross-grid electroluminescent panel.

in the off state To maintain this situation, a flood beam illuminates the element.

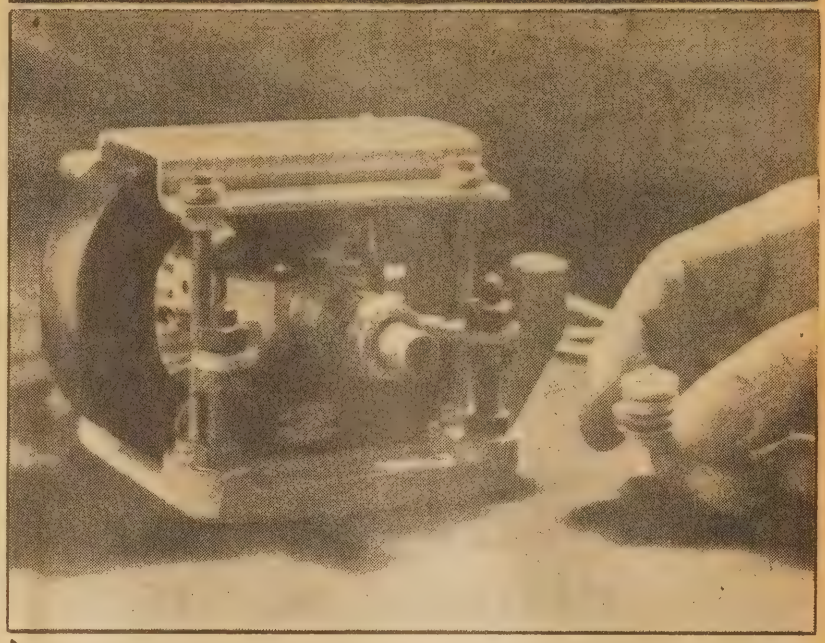
To make the controlled-persistence panel a practical device, the panel itself can be used as the screen in a cathode-ray tube

If the electron beam is allowed to bombard directly the photoconductive layer of the panel, bombardment conductivity induced in the layer modulates the display. One difficulty with this technique is maintenance of an adequate vacuum

---

SEEING in the dark has long been an objective of the U.S. Army—with the aid of electronics—in order to improve our troops' effectiveness at night. The newest cat's eye, developed by the Army Engineer Research and Development Laboratories and R.C.A., can "see" by reflected starlight or the faint glimmer of skyglow falling on an object. By means of image tubes and an optical system, the newly developed instrument intensifies or amplifies the small amount of light sufficiently to present a visible image. The device—technically known as a "cascaded photosensitive image intensifier"—requires no source of artificial light or radiation, as in other systems Many civilian uses are foreseen including applications in astronomy

VOLTAGE TUNE MAGNETRONS



Packaged voltage-tunable magnetrons, consisting of tube, magnet, cavity, and associated accessories, are now being offered as pre-tuned and adjusted units by International General Electric.

A relatively new concept in cross-field devices, IGE's voltage-tunable magnetrons are essentially high-frequency generators for the microwave bands.

Tuning characteristics are linear over a 1.7 to 1.0 frequency range or greater, with changes in anode voltage. Mechanical tuning is not necessary.

Department engineers say that no additional circuitry is needed to adapt the voltage-tunable magnetron package for oscillator service since it is a complete pre-assembled unit.

First of the new units, GE developmental type Z-5300 for S-band use, offers improved stability, efficiency, and power output, according to the engineers. Wide-band range is from 2200 to 3850 megacycles with a minimum CW power output of two watts across the entire frequency range.

GE is now developing voltage-tunable magnetrons to cover a frequency spectrum from 50 megacycles to over 8000 megacycles.

SEMI-CONDUCTOR VARIABLE CAPACITORS

(Continued from Page 23)

citance and the resonant frequency of the tank circuit, resulting in frequency modulation of the oscillator.

A very unusual application of the variable capacitor diode has been under study for some time. This is its use as the variable reactance component in a whole new class of amplifiers known as variable reactance or "varactor" amplifiers. These units require a variable reactance, or "varactor," as the active element. The semi-conductor diode capacitor can serve as the "varactor" since its capacity and thus its reactance varies with the applied voltage.

Extensive work on "varactor' amplifiers has been carried out at Bell Telephone Laboratories, where it has been found that useful low-noise amplication is possible with the semiconductor diode serving as the "varactor" element. In fact, using several of the diodes in a sort of travelling-wave-tube configuration, a bandwidth of 100 megacycles at a frequency of 400 megacycles has been achieved This amplifier introduces less noise into the signal being amplified than conventional vacuum-tube amplifiers or mixers, thus making it potentially useful in u.h.f television receivers

In another experimental diode amplifier undergoing tests at Bell Telephone Laboratories, useful low-noise amplification was obtained at 600 megacycles with a bandwidth of about 8 megacycles. Such performance indicates that this type of amplifier can be of value in improving the sensitivity of microwave receivers associated with such systems as radar, radio astronomy, and microwave relays.

Another interesting application of the semiconductor diode capacitor is its use as an up-converter with gain. In a new type of microwave system under development at Bell Telephone Laboratories, such diodes are used to provide gain in up-converters where the frequency is changed from approximately 70 megacycles to about 6000 megacycles This is the first instance of up-conversion using a semiconductor diode in which there was no measurable loss.

From the foregoing we can see that solid-state research has led to a new device which shows promise of becoming an extremely useful component in the electronic industry.

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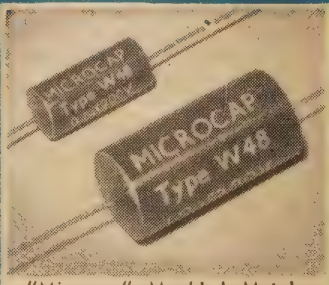
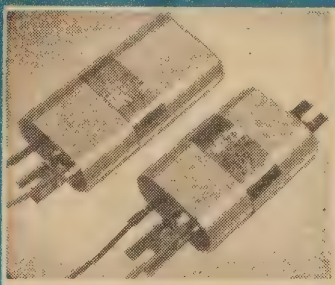


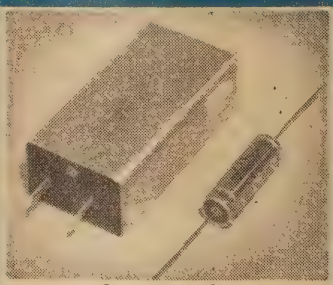
"Microcap" Moulded Metallised Paper Capacitors.

Moulded Foil & Paper Tubular Capacitors.



Fluorescent Power Factor Capacitors.

Interference Suppression Capacitors.



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NEWS AND VIEWS OF THE MONTH

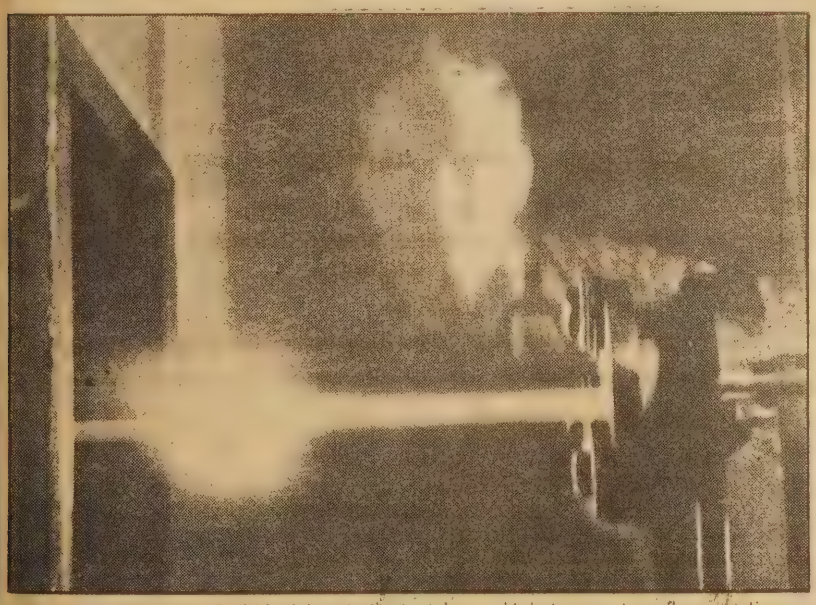
Materials for heat

WITH yesterday's "high-temperature" materials all but melting away under the intense heats of today's rocket engines, scientists are looking to new technology to produce the materials of tomorrow.

Picture on this page shows a technician watching through an observation port in a flame-test chamber as a new graphite-base material is put through its paces. Positioned in a jet of exhaust gases travelling at five times the speed of sound from an oxygen-kerosene flame (note characteristic diamond-shaped supersonic nodes), the conical specimen reaches a white heat of approximately 5,000 degrees Fahrenheit (2,690 deg. Centigrade) in a matter of seconds.

Conventional graphite erodes beyond tolerable limits in about eight seconds, but materials have been produced that hold dimensions ten times longer, and in development are materials which will hold their dimensions on even longer cycles — well beyond the normal operating requirements of rocket engine components.

The new knowledge being gained is expected to exceed everything previously learned of the behaviour of materials at temperatures approaching that of the sun's surface, and gives promise of resulting in a whole new "family" of high temperature materials for both industrial and military equipment of the future.



Technician at Union Carbide laboratories watches a high temperature flame testing a new graphite-based material intended for rocket engines.

Ancient flame

A FLAME has burned without a break since 1680 over the furnaces of the British firm that produces the well-known Whitefriars glass, which provides — among a host of other objects ranging from wine glasses to stained glass windows — the glass tubing for all the thermometers made in Britain.

When the firm moved to new premises in North London in 1923 they brought a brazier of burning coke from the old factory in a lorry to start the first new furnace. There are now three, kept at a heat of between 1,350 and 1,400 degrees Centigrade.

Above each furnace, the flame rises in a jet into the domed oven on the first floor where the glass is melted. The molten "metal" as the glass is always called in the trade — is heated in great pots for 36 hours before it is ready for use. These giant crucibles are made on the spot in just the same way as they have always been made.

Even to this day the best method for kneading the clay for the crucibles is with the bare feet, a method that excludes air bubbles better than any other. The operator hangs on to ropes while he walks about kneading the clay.

Big sound for tests

THE world's most powerful hi-fi sets are being used by the aircraft and missile industry to test its products.

Highly intense noise, provided by random noise generators and amplified to an ear-splitting 145 decibels by three 600-watt loudspeakers, is used, for example, by G.E.'s Missile and Space Vehicle Department to test missile and space vehicle components.

Extreme vibrations set up by these noise levels approximate those produced by rocket and jet engines. To insure components against failure caused by noise vibration, aircraft and missile manufacturers, using such noise devices, can first test components in the laboratory.

In a 120 cubic feet chamber, whose seven walls avoid parallel alignment, three 600-watt loudspeakers blare into the chamber, noise 300 times greater than that of the average home hi-fi set turned to full volume.

This giant hi-fi facility is used to test the nose cone electronic components — amplifiers, recorders, and other noise sensitive devices — before they are installed in the nose cones for Atlas and Thor missiles. By allowing the noise to flow into a 3,150 cu. ft room, a complete nose cone can be tested.

Medical Reactor

WORLD'S first nuclear reactor designed specifically for medical use, has been opened at the Brookhaven National Laboratory.

Brookhaven is operated by Associated Universities, Inc., for the U.S. Atomic Energy Commission.

In addition to its reactor, the new centre includes a 48-bed hospital for research patients and laboratories for students on the medical applications of atomic energy.

Begun two years ago, and completed at a cost of £2,320,000 the centre is part of the Commission's program for medical research.

The reactor, which will begin operation this year, is specially designed for the treatment of animal and human patients.

Two ports on opposite sides of the reactor permit streams of neutrons from the core of the pile to pass through heavy shielding walls into treatment rooms.

These beams can be shut off in three seconds, and can be varied in strength and type.

A third face of the reactor is equipped for the general irradiation of large objects.

The fourth has tubes leading into its core to permit insertion of small samples of various materials for diagnostic purposes and the making of short-lived radio-isotopes.

Airborne Missile

THE U.S. Air Force plans to bolster its air power with a missile that can be fired from bombers.

The first of the high-speed, nuclear-tipped weapons may be ready by late next year.

They will have a range of more than 1,000 miles and will be launched from beneath the wings of bombers.

Officials said the missile would have these advantages:

- It would be a retaliation weapon which could not be knocked out easily. Therefore it will vitally strengthen U.S. deterrent power.
- It could extend the useful life of present-day bombers by enabling them to launch missiles well away from enemy defences.
- The weapon could confound Russian defences because it would be in motion constantly and be relatively invulnerable compared with big, fixed-base intercontinental ballistic missiles.
- It could be flown relatively close to targets in emergencies, but recalled. An I.C.B.M. cannot be stopped once it is launched.

The A.L.B.M., because of earlier research on other weapons, can be developed quickly and relatively inexpensively.

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„ accuracy:	±0.2db.
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Output Impedance:	a/600 ohm unbalanced. b/600, 150, or 50 ohm balanced.
Frequency coverage:	0 to 100 Kc/s for 600 ohm unbalanced. 30 cycles to 20Kc/s for balanced positions.
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Radioactive book

A BOOK on radio-activity, written by atom pioneer Lord Rutherford, was found to be really radio-active, according to "The Times."

The newspaper said an American who bought the book, "Radio-active Substances and their Radiations," from Blackwell, an Oxford firm, had written to it recently on the matter.

He had said, "Knowing the haphazard manner in which radium was handled by such pioneers . . . it occurred to me that the book may be radio-active."

The American had continued, "I detected 1,000 counts a minute of an alpha-emitting substance on the inside cover.

"Examination of the radiation by alpha-pulse analysis has not yielded a positive identification, but it seems possible that the substance is indeed radium."

Sarnoff looks ahead

THE television industry in 10 years will offer three-inch screens for picnics and a thin, mural-sized screen for living-rooms, according to the chairman of the National Broadcasting Company Board (Mr Robert Sarnoff).

He was speaking at the 36th annual installation banquet of the Los Angeles Junior Chamber of Commerce.

Mr Sarnoff said: "By 1969 we can expect live television to take us to London for the changing of the Guard at Buckingham Palace, or an interview with the Prime Minister.

"We will see car races in Monte Carlo, the bullfights in Madrid, the music festival in Edinburgh.

"We will witness the Olympics, the splendour of the Papal Court, the Nobel Prize award dinner in Stockholm—perhaps even the Folies Bergere in Paris."

Mr Sarnoff said technical advances would enable industry to build a TV set with a three-inch screen that would work on the beach, in trains and in planes.

He said: "For home use, the 1969 set will replace the present picture tube with a thin, flat screen that can be hung on the wall like a painting — up to mural size if you like.

"The viewer will operate it from a small box at his side.

"You will be able to show your home movies on the same screen."

Mr Sarnoff forecast that in 10 years 70 million TV sets would be operating in 58 million homes.

Jupiter sends signals

RADIO astronomers have found a strong radio signal from the planet Jupiter, but it does not come from an "intelligent" source.

The announcement was made by Australian Dr E. G. Bowen, chief of the C.S.I.R.O. radio-physics division.

"If intelligent beings are broadcasting radio signals from planets, the signals are much too weak and are being drowned out by the more powerful natural signal sources," Dr Bowen said.

The signal from Jupiter, which still was being received after more than two years, could be caused by a tremendous volcano or a big electrical storm, he added.

In U.S. to confer with California Institute of Technology engineers on construction of a 210-foot radio telescope in Australia, Dr Bowen said many things are happening on the sun which cannot be seen by light waves.

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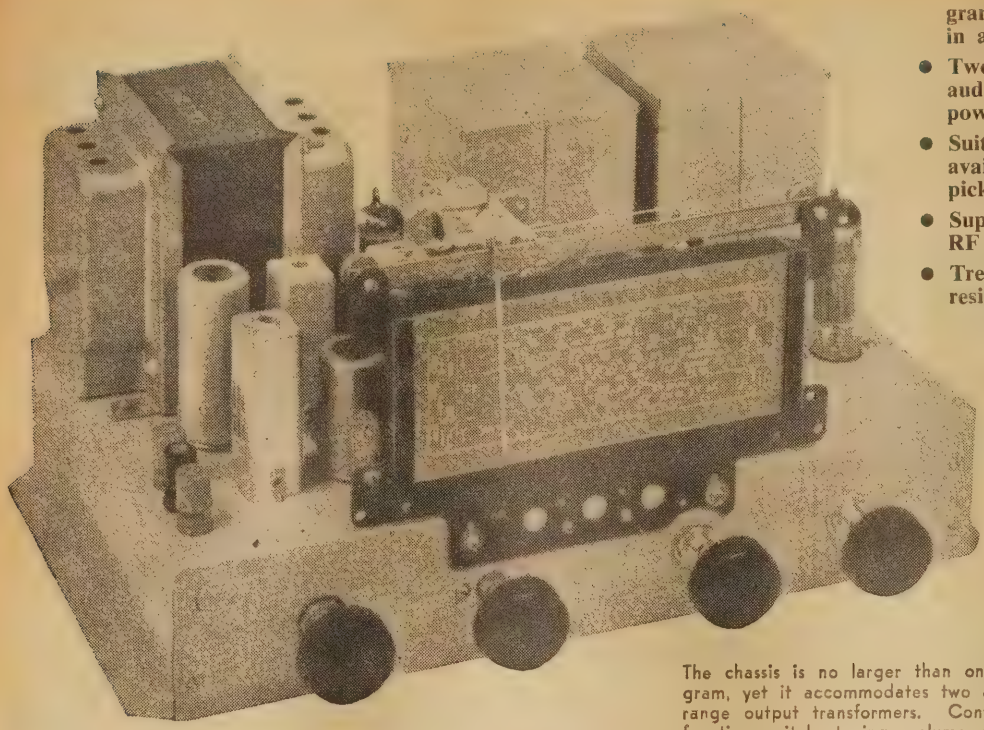
- **Treble tone control—low residual hum level.**



The chassis is no larger than one for an ordinary radiogram, yet it accommodates two audio channels with wide-range output transformers. Controls are (left to right) function switch, tuning, volume and treble tone control.

A 5-Valve Stereo Radiogram

To enjoy stereo sound reproduction is not the exclusive right of Hi-Fi fans, using hundreds of pounds worth of equipment. This new stereo radiogram is no larger and only a little more complex than a conventional receiver yet it makes available sound in quality and quantity ample for all requirements up to the high-powered, super-quality field.

by John Moyle

LAST month we published an article dealing with the general problem of using stereo with simple amplifiers, and included some circuits and layouts showing how an existing radiogram of modest proportions can be adapted for stereo by simple circuit changes and the addition of an extra unit to drive the second speaker. We also mentioned the possibility of describing a complete chassis which would combine our ideas into one unit.

This month we have taken this step, and the project to be detailed here is our idea of just how simple it is to make an excellent little stereo radiogram .

CAN BE SIMPLE

It might be in order to reiterate here that stereo is far from being something applicable only to hi-fi combinations and expensive sets.

It is an effect which primarily has nothing to do with either. Its virtues stem from the fact that, with two channels, simple or complex, we can obtain an effect of space and realism not possible with one. The virtues of stereo are due entirely to this effect, and it can be enjoyed whether the equipment which plays it is large or small.

The value of high quality amplifiers and speakers is no less important with stereo than for single channel, and a high-grade stereo combination will sound so much better simply because its components are better.

But not all of us are rich or interested enough to collect the units needed for top quality and many of us couldn't house them if we did.

We settle for more or less conventional equipment having a modest output adequate for our needs, and which doesn't take up a great deal of room or break the bank book.

Primarily this radiogram is aimed at this large group, but at the same time, because we can use better output transformers than many inexpensive designs, and pick the type of speakers we want, results can in most cases exceed those of commercial examples.

Just because we use single-ended amplifiers and moderate power doesn't mean that the sound cannot be very nice to hear, even if bench tests show that it has its necessary limitations.

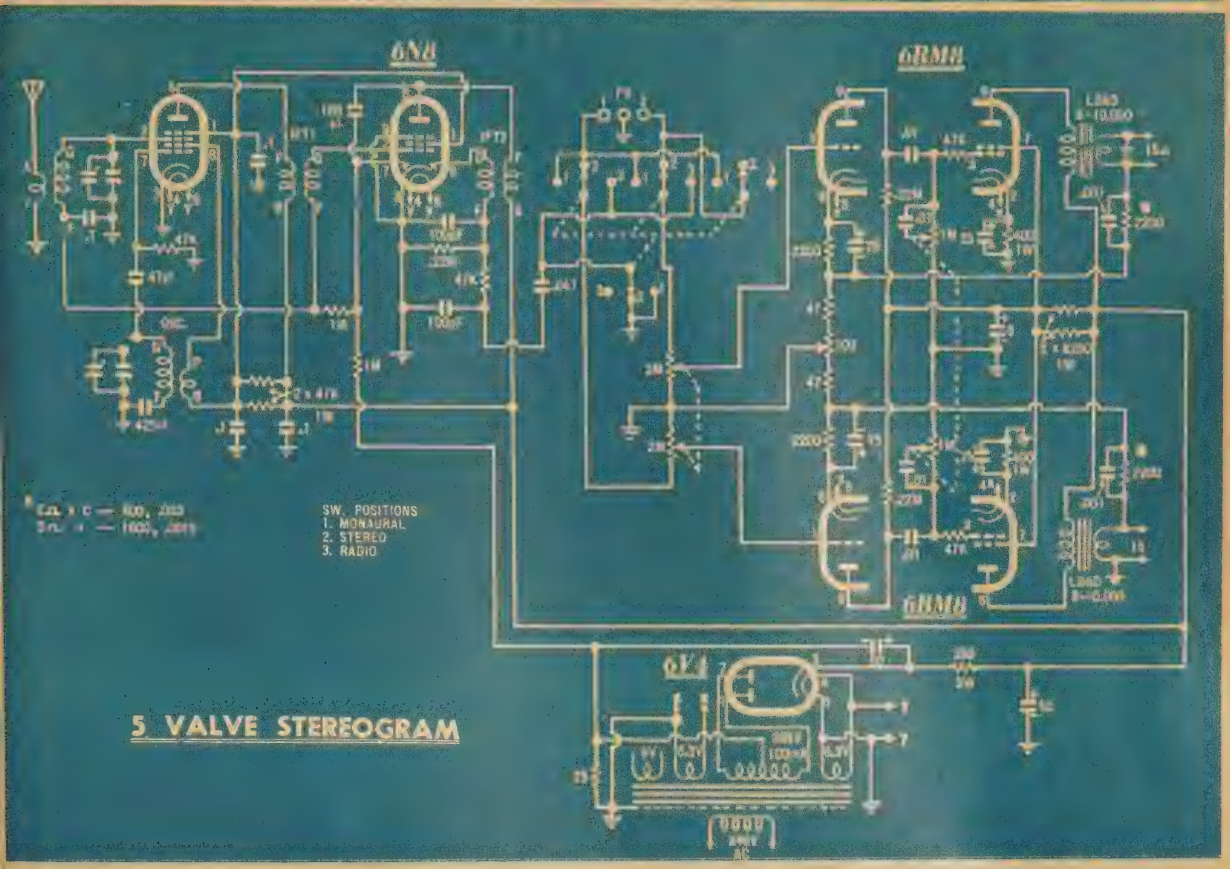
PLENTY OF OUTPUT

As we very quickly found when testing the equipment outlined last month, two channels of up to 3 watts each can make an awful noise in the average room, and the class of listener mentioned earlier isn't likely to use full output except on rare occasions.

Such people seldom use an average output of more than a few hundred milliwatts, you may be surprised to hear, and with the higher efficiency of many modern speakers, this is transformed into much more actual sound than we have been used to in the past.

This isn't an apologia for what will probably be the baby of our stereo range. But it is a plea that, just because it uses only five valves in all, and

CIRCUIT DETAILS OF OUR FIRST STEREO RADIOGRAM



The circuit is basically very simple, though the extra audio channel and the switching tend to make it look complex at first glance. The whole receiver operates from a single 100-milliamp power supply.

looks such a simple thing, you should not under-rate its excellent results, nor expect from it more than it was intended to give.

This element of simplicity was something we deliberately set out to achieve, and we have used no more or less in the way of components than are necessary to give the results we wanted.

These were to play the local radio programs with the same general facility as enjoyed by similar radiograms in the past, and to include the simplest audio end we could devise.

STANDARD TUNER

This, by force of circumstances, boiled down to the standard type of tuner using a converter and IF-detector stage, followed by a pair of 6BM8 triode-output valves, each of which will give a maximum output of about 3 watts with an efficient output transformer and with the minimum number of controls.

The physical dimensions of the chassis are quite small, and it can be housed in an appropriately small cabinet if so desired. But for those who might be more ambitious, we so arranged the positions of the tuning dial and controls that the chassis can be accommodated in a conventional radiogram chassis. The dial, as pictured, is a small one, but there is no reason why something more imposing should not be substituted if your tastes run that way. This might, in turn, involve some modification of the gang position and a few small parts.

Actually, there is nothing critical about their exact placement, and they can be moved about a little without affecting the results, provided they are kept, as we have them, as near as possible to the appropriate sections of the wiring.

On the other hand, we have taken considerable trouble with the layout to help you in putting it together, and to avoid the juxtaposition of any leads which should be kept separated or short. So don't depart from it unless you are quite sure of what you are about.

There is nothing remarkable about

PARTS LIST

1 Chassis 12 x 7½ x 2¼ inches.
1 285 volt 100 mA power transformer.
1 Dial to suit gang (USL 37 or larger, if preferred).
1 2-gang miniature (AWA).
2 455 Kc miniature IF's.
1 Miniature oscillator coil.
1 Miniature aerial coil.
5 Noval sockets.
1 4 x 3 Oak switch.
2 output transformers (8,000-10,000 ohms load) to suit speakers selected.

VALVES

1 6V4, 1 6AE8, 1 6N8, 2 6BM8.

CAPACITORS

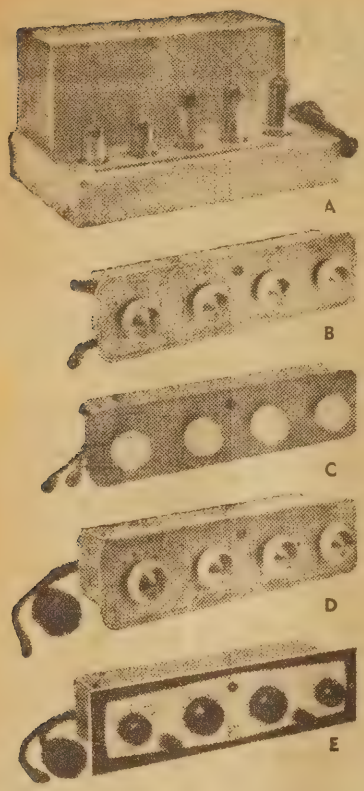
2 50 mfd 350 volt electrolytics.
1 8 mfd 350 volt electrolytic.
2 25 mfd 40 volt electrolytics.
2 25 mfd 12 volt electrolytics.
1 .1 mfd 4000 volt paper.
2 .1 mfd 200 volt paper.
1 .047 mfd 200 volt paper.
2 .01 mfd 400 volt paper.
2 .01 mfd 200 volt paper or ceramic.
2 .001 mfd mica or ceramic.
1 425 pF mica padder.
3 100 pF mica or ceramic.
1 47 pF mica or ceramic.

RESISTORS

2 1 meg ½ watt.
3 .22 meg ½ watt.
4 47 K ½ watt.
4 2200 ohms ½ watt.
2 47 ohm ½ watt.
1 25 ohm ½ watt.
2 47K 1 watt.
2 8200 ohm 1 watt.
2 400 ohm 1 or 3 watt.
1 390 ohm 5 watt.
1 2 meg 2-gang potentiometer.
1 1 meg 2-gang potentiometer.
1 100 ohm WW potentiometer.

SUNDRIES

2 speaker plugs and sockets, 6 inch length of component strip, 1 seven-lug mounting strip, 1 three-lug mounting strip, 1 two-lug mounting strip, 5 terminals, nuts and bolts, solder, solder ligs, tinned copper wire, spaghetti, hook-up wire, 5 knobs, 3 core power flex and 3-pin power plug.



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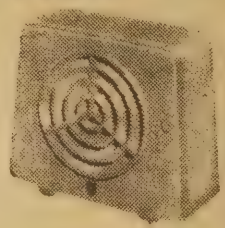

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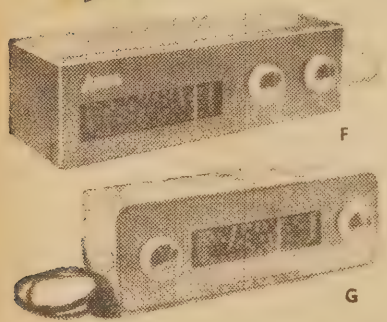

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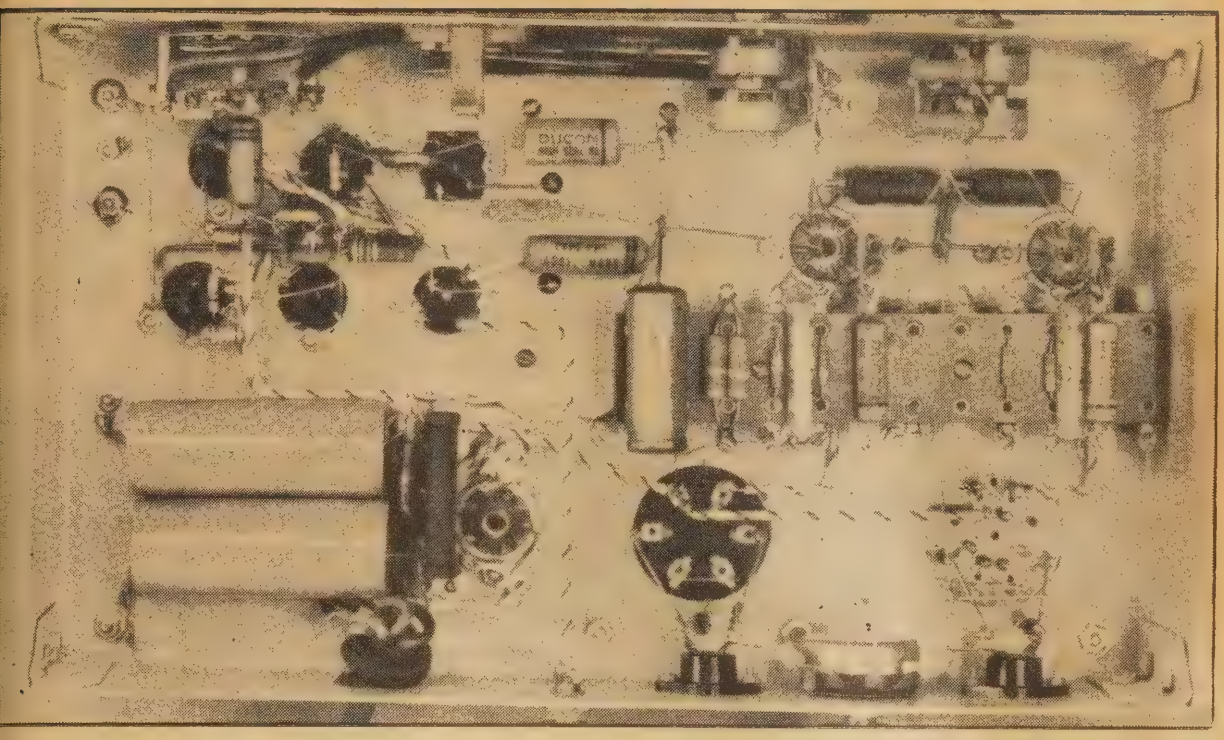
UNDERNEATH WIRING OF STEREO RADIOGRAM



The wiring beneath the chassis is open and easy to get at. Tuner is at the top left, power supply below it. The audio system, occupying the entire right-hand half of the chassis, is symmetrical electrically and mechanically. The balance control is between the two speaker sockets.

the tuner as such. It follows standard practice and uses standard components. In order to keep the tuner and amplifier quite separate, the IF valve also serves for the second detector and AVC circuits. Bias for the first two valves is obtained from a back bias resistor which saves several components and also space round the valve sockets. It will tune in all the locals at full strength and plenty of interstate stations as well.

AUDIO SYSTEM

The interesting part of the set really centres in the audio amplifier, which has, of course, two separate channels with ganged controls.

Switching from radio to records is done with a single wafer switch. When playing radio it parallels both audio channels so that each loudspeaker gives out with the same program.

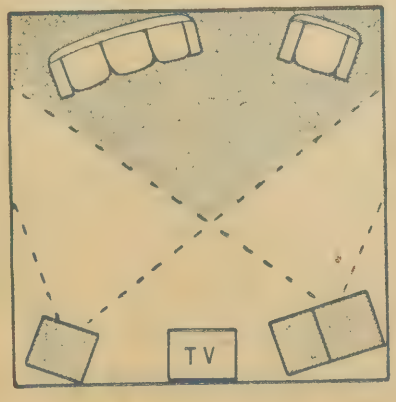
In most cases this is a big improvement on a single speaker. First of all, it spreads the sound over a larger area and gets away from the single point source of sound to a remarkable degree. Very few people will fail to notice the improvement, although it is best appreciated on orchestral combinations, which provide us with so much of our entertainment.

Secondly, the sharing of the output between two amplifiers means that each is operating at a much lower level than with a single channel, giving the same volume, and the speakers are also able to share the load. This is a marked advantage, particularly where inexpensive units are used, as they undoubtedly will be.

The result is less distortion and more relaxed listening.

Operated this way, you will really have a 6-watt amplifier at your command. This is much more power than you ever had with your old radiogram, which would probably produce no more than about 4 watts.

When switched to the stereo record position, the two channels are split up, so that each is fed from the output of the two separate units of the pick-up, and automatically give stereo from stereo discs.



If the furniture in the room can be arranged in this fashion, a favourable situation is created both for stereo listening and TV viewing. Exact placement and inclination of the speaker cabinets, as well as level, can be established by trial and error.

On standard LP's, the same general remarks apply as they did to radio reception. Results will almost certainly be vastly better on almost any records, and again you will have a 6-watt channel to play them.

On stereo the position is not quite the same, as occasionally most of the program will come from one speaker which must reproduce the lot. But the large majority of the program will be shared between the two, so that the advantage of the more powerful output is still largely achieved.

The switch provides a further position which connects the pick-up sections in parallel for playing LP records, but opinion is divided as to whether this is a good thing or not. Personally, we have rarely noticed any difference. It is possible that the cut on each side of an LP record may not always be exactly balanced, and each channel, therefore, when separately extracted may not be exactly the same. This, if so, could produce a mild form of stereo which some people claim to hear.

SWITCHING SYSTEM

We mention this merely in passing. It is quite easy to wire the switch to give both, and this we have done.

The two audio amplifiers are based on the 6BM8 circuit as described last month. Their load was originally specified as 10,000 ohms for lowest distortion, but as good transformers of this impedance are not easy to obtain, we have used a good quality type of 8,000 ohms with no discernible difference.

The power output is just on 3 watts with the plate voltage reading 266 volts

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ELECTRONIC DEVELOPMENTS

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referred to the chassis, and 216 volts on the screens. This means that the bias for each valve is 16 volts.

With less expensive transformers, the output might well drop to 2.5 watts or even lower, and although this still sounds O.K. it is well worth paying extra for the best transformers you can get.

It is much harder to make a good single-ended transformer than a push pull type, so that quality is much more important and efficiency not so easy to obtain.

A volume control for each channel is required. To preserve balance, and keep both channels in step, they must be ganged together. Because they represent the pick-up load, and most stereo crystal pick-ups are designed for a 2 meg load this is the value to use. The pick-ups will give substantially flat output under these conditions so that no further compensation is necessary

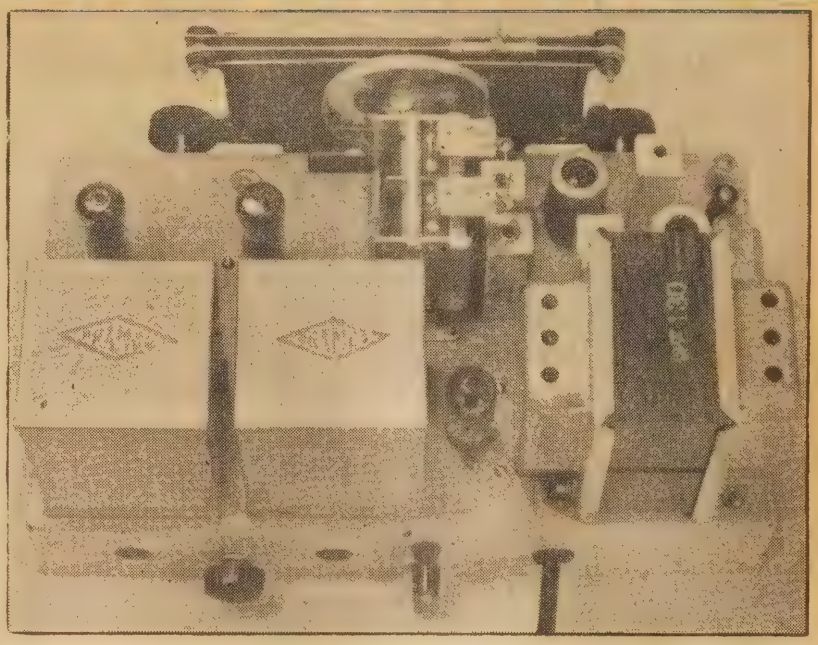
MATCHED CONTROLS

Special controls can be obtained in which the variation in resistance with rotation is matched to a few db, and these should be ordered if possible.

But because there will be times when a cut in high frequency response will sound better, we have included a tone control to chop the highs if you so desire. It is rarely, if ever, an improvement to boost them, and the bass response is generally O.K. as it is.

So, in the interests of simplicity, we have not provided any further tone controls, particularly as they would have complicated the circuit and even called for radical changes which would have cut right across our operational requirements

A REAR VIEW OF THE CHASSIS



This top photograph shows the placement of all major components. Aerial and earth terminals are at the back, pickup to the front right. Our blueprint will show the chassis slightly wider than it is here, in order to accommodate other brands of power transformer.

The tone control operates in the grid circuit of the output valves. This isn't an ideal method, as it is within the feedback loop, but again we were after simplicity and it works very well without affecting stability in any way.

One other control is provided which, once set, can be left alone. It is the balance control which evens up the gain of each channel to compensate for possible differences in the output of each pick-up section, or for the different efficiencies of the speakers.

We can't use the method employed in the stereo control unit, because if we did we couldn't turn the gain right off

So we incorporated it in the feedback circuit in such a way that it varies the feedback applied to each channel by an appropriate amount, which also varies the gain in proportion.

In practice, the balance control should never need to be moved very far from the central point—if things are so unbalanced as to require this we suggest you look for the reason elsewhere.

There is about 14 db of feedback for each channel, and the control allows for the subtraction of about 4 db from one side and an equal amount added to the other, a total variation of about 8 db.

This is accomplished with a wire wound potentiometer mounted at the rear of the chassis where it will be easily reached. Part of the feedback resistor in the triode cathode circuit is made up by the potentiometer and the earth point is simply varied about the centre to change the effective feedback. It works very well and has no complications.

NO NOTICEABLE EFFECT

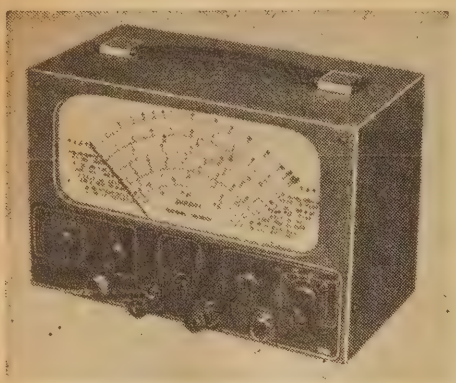
The addition or subtraction of such a small amount of feedback has no noticeable effect on quality remembering that the full variation will rarely be needed.

The power supply is again very simple and similar to that we have used successfully in the past. The main smoothing is taken care of by two large filter capacitors of 50 mfds each and a resistor which also serves to reduce the voltage to the correct amount for the valves.

Only one other filter capacitor is needed, and it is used as a bypass at the far end of a dropping resistor which feeds the screens of the output valves and the plate resistors for the triodes.

There appears to be no advantage in separating these feed points and providing one for each channel, but a common bias resistor for the two output stages would not be a good idea, as the

This home-made speaker cabinet, as described in the September, 1958, issue, is an excellent proposition to mate with an existing radiogram. Absorbent internal baffles minimise box resonant effects and allow a surprisingly good bass response to be achieved



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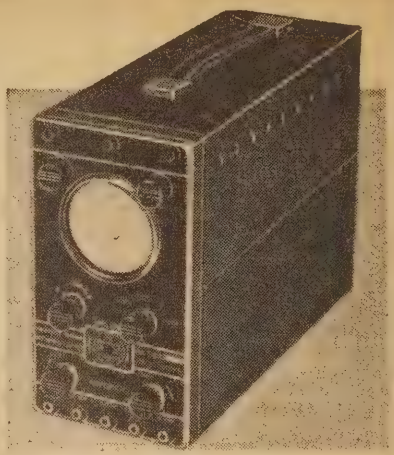

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This smartly styled Electronic Voltohmmeter is suitable for TV and radio servicing and employs a large 8in illuminated meter. It will measure negative D.C. voltage, positive D.C. voltage and A.C. voltage in steps of 1, 3, 10, 30 and 100, 300 and 1,000 self contained. Peak-to-peak A.C. voltages may be measured up to 2,800 volts. There are seven ranges of resistance up to 1,000 megohms and the D.C. voltages can be extended to 30,000 volts by use of the external probe Model T.V.30. Crystal probe and valve probe enable R.F. voltages up to 1,000 to be checked and the wide frequency response makes it entirely suitable for TV servicing and other applications.

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UNIVERSITY T.V.R.-C.3. OSCILLOSCOPE 3 INCH

This Oscilloscope for bench or portable use is ideal for TV, radio and industrial use and embodies all the features of larger instruments. The vertical amplifier has a response of 15 c.p.s. to 1 Megacycle within plus or minus 1 db. The time base is a Miller phantastron circuit with a frequency range of 15 c.p.s. to 25 Kc in 5 steps with fine control. Complete with graticule and instruction manual. Size: 4½in x 8½in x 11½in. Weight: 14lb

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danger of cross coupling would be too great.

We have taken particular care with the layout of the set, not only to avoid complications but to help you build it.

The tuner is grouped to one side of the chassis and the progression of wiring arranged so that there is no doubling back or long leads. The components are supported mainly on a single tag strip and are mostly in plain view. The switch is nearby where it is convenient to the pick-up terminals, placed at the side for easier access, and to the output from the tuner.

Two shielded co-ax leads run across the front of the chassis to the volume control, and the tone control is on the far side away from the rest of the wiring.

TERMINAL STRIP

From this point all the wiring works towards the rear of the chassis, where the output transformers are mounted.

With the exception of the output valve bias components, and the feedback network, all the remaining components are mounted on a terminal strip which may be prefabricated before wiring into the circuit. They are symmetrical and well spaced to avoid interaction.

The voltage dropping resistor for the screens and triode plates, actually two in parallel, is on the end of the strip, where it runs away to the main filter components, also mounted on a tag strip and located near the rectifier.

The two speaker outlets are mounted on the rear of the chassis, and the balance control is between them, so that the feedback components can be bridged across their terminals.

All this makes for easy and short connecting leads and makes even printed circuits seem unnecessary.

We have provided you with a retouched photograph of the underchassis wiring, and also a diagram of the audio strip, to help you locate all the components.

It is important, when mounting the audio transformers, that the plane of the laminations should be at right angles to those of the power transformer, and that all the transformers should be mounted along the same centre line.

RESIDUAL HUM

If you do not do this there will be some coupling between the power and audio and a hum will be introduced into the output which will persist even if the valves are not in the chassis. The hum voltages will be fed directly into the loudspeakers and can be quite noticeable. The audio transformer should be mounted in the same plane, and there is no noticeable coupling between them.

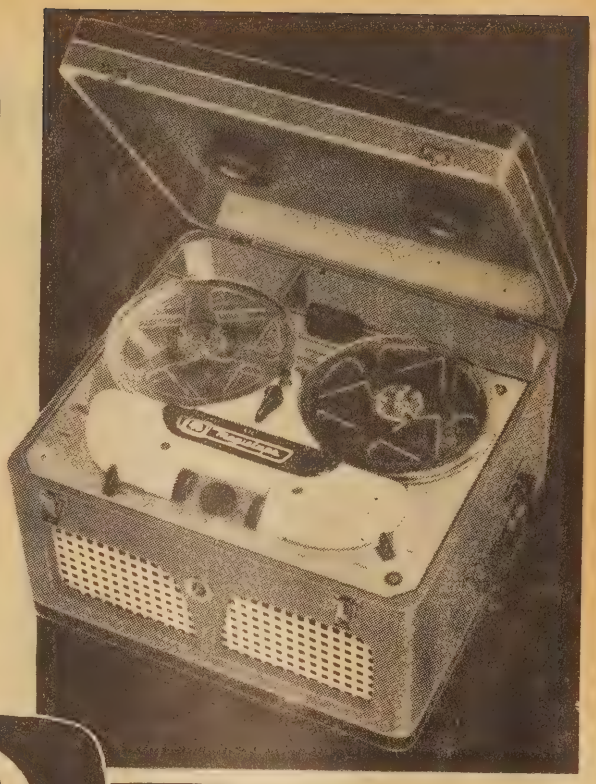
The overall performance of the amplifiers will depend almost entirely upon the quality of the output transformers. Ours were substantially flat from around 50 cycles to about 40 Kc, with quite a good power output curve. Square waves looked good also, with a little more ringing than for our bigger push-pull jobs, but still quite sharp and clean even at 5 Kc.

Stability is excellent, and oscillation could not be induced under any conditions of load, and even with more feedback applied.

The value of the phasing capacitor across the feedback resistor may need modification with other transformers, but our value should be fairly right if you have no means of checking.

(Continued on Page 119)

now with three speeds and exclusive twin 6" speakers!



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Two Input Channels: (1) high gain, high impedance for microphone, home radios, TV sound and disc pick-ups; (2) radio tuner input.

Microphone: High sensitivity type to attach to standard microphone stand.

Speakers: Two specially matched 6in A.W.A. loudspeakers for high-fidelity reproduction.

Dual Tone Controls: Two separate controls are included, allowing complete and independent variation of treble and bass registers.

Rev. Counter: For forward and reverse directions; immediate location of any subject matter on tape. Turn knob anti-clockwise to reset at zero.

Fast Rewind: Simple lever control, rewinds full spool in 85 seconds.

Fast Forward: Simple lever control, winds full spool in 95 seconds.

ON/OFF Monitor Switch: Allows program to be checked while recording.

Erasure: Fully automatic A.C. erase on record.

Public Address: Position on function lever fits Magictape for public address unit or portable amplifier with extension speakers.

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Weight: 34lb.

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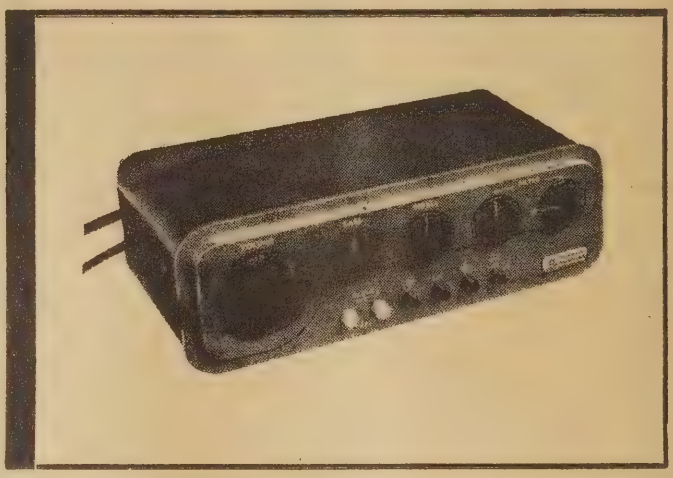
ACOUSTICAL QUAD

Since its introduction, the Acoustical Quad II has been refined in detail, but the outstanding features, anticipating trends in both amplifier and associated equipment progress, have established the soundness of Quad's basic design throughout the world. There is no doubt that the Quad II is the finest amplifier which it is possible to devise.



The Quad II amplifier is, in every respect, able to produce the closest approach to the original sound. This is the criterion, whether it is being used for radio, recordings, tapes, or microphone, the Quad's superb quality is reflected throughout the electrical and mechanical design. It gives a power output of 15 watts throughout its frequency range 20-20,000 c/s with an input sensitivity of 1.4 V.

Quad QC II Control Unit Specification

FREQUENCY RESPONSE:
Cancel position, Radio & Tape inputs: 20-20,000 c/s within 1db.
Cancel position, Microphone input: 20-18,000 c/s within 1db.
Cancel position, Pick-up input R.2. Within 1db of stated characteristics. No significant change.
Bass and Treble controls: Within 1db. of published curves.
Filter frequencies: 5 Kc/s, 7 Kc/s, 10 Kc/s ± 250 c/s.
Filter slope: Level to approximately 50 db/Octave.

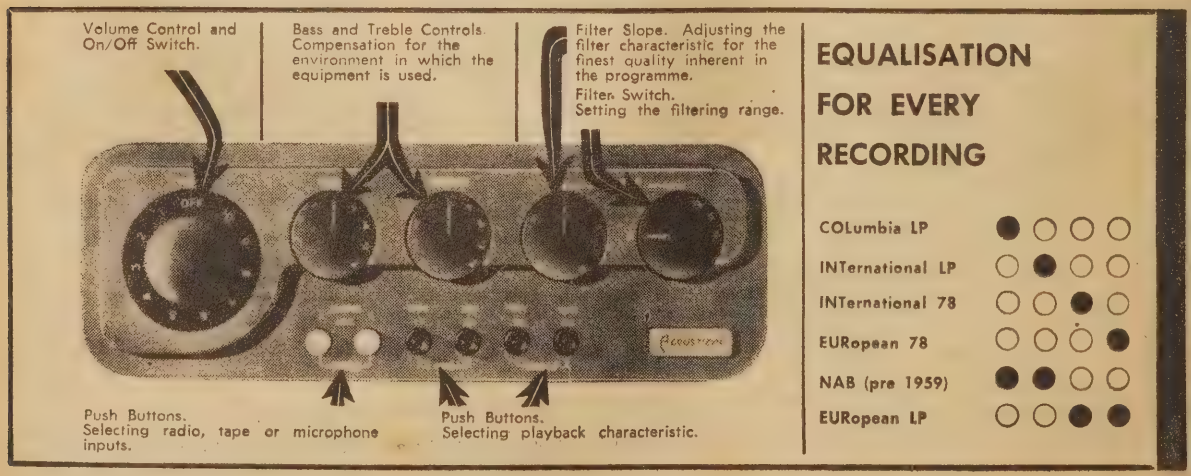
INPUT SENSITIVITIES (for 1.4 V.rms output):
Radio and Tape ..... Internal impedance ..... 100 KΩ : 100mV.
Microphone ..... Internal impedance ..... 100 KΩ : 1.5mV.
Pick-up ..... Depending upon adaptor unit

DISTORTION (1.4 V. output):
All controls "level," Radio output or R.2 pick-up input: 0.02% approx. Least favourable arrangement of controls: less than 0.1%.

POWER SUPPLY:
The unit takes its power from the main amplifier.

BACKGROUND:
—70 db. or, where applicable, approximately 6 db. above equivalent thermal noise of input impedance.
DIMENSIONS: 10½" x 3½" x 6½". **PRICE:** £54/-/-.

***Except for Chairside Cabinet, prices mentioned are fixed in all State capitals.**


Volume Control and On/Off Switch.
Bass and Treble Controls. Compensation for the environment in which the equipment is used.
Filter Slope. Adjusting the filter characteristic for the finest quality inherent in the programme.
Filter Switch. Setting the filtering range.
Push Buttons. Selecting radio, tape or microphone inputs.
Push Buttons. Selecting playback characteristic.

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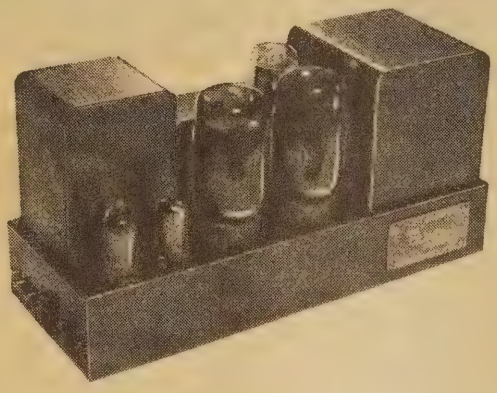
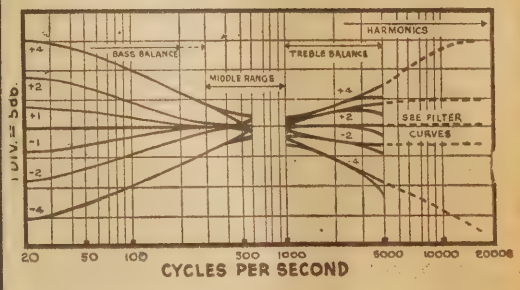


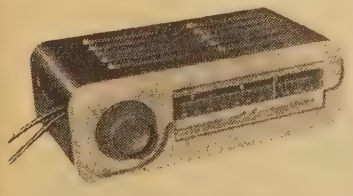
Specially designed chairside cabinet holds Turntable, Quad II amplifier, QC II Control unit, AM or FM Tuner. Price for cabinet, £69/15/- (N.S.W. only).

Quad II Amplifier Specification

POWER OUTPUT:
15 watts throughout the range 20-20,000 c/s.
FREQUENCY RESPONSE:
Within 0.2 db. 20-20,000 c/s.
Within 0.5 db. 10-50,000 c/s.
DISTORTION (measured at 12 watts output):
Total 3rd and higher order: less than 0.1% at 700 c/s.
Higher order alone ——— less than 0.03% at 700 c/s.
Valve mismatching up to 25% not to cause distortion to exceed 0.18%.
Total distortion at 25 c/s not to exceed 0.25%
INPUT:
Sensitivity ——— 1.4 V. rms. for 15 watts output
Load imposed on input —— 1.5 MΩ in parallel with 10 PF.
BACKGROUND: —80 db. referred to 15 watts.
OUTPUT IMPEDANCES: 15Ω and 7Ω.
Effective output resistance: 1.5Ω for 15Ω output.
DIMENSIONS: 13" x 4¾" x 6½"
MECHANICAL:
All windings impregnated and housed in compound filled casings. All metal work fully rust-proof processed and stoved steel grey. Metal work, rust-proofing, finishing, transformer winding, tropicalisation, assembly and tests, all carried out under constant supervision Suitable for use under all climatic conditions.
PRICE: £61/5/-.



Curves showing slopes of response provided by the bass and treble controls. Adjustment is continuously variable.



FM TUNER

FM TUNER—The Acoustical FM Tuner operates in conjunction with the Quad II amplifier through your Hi-Fi speaker system. The tuner is so sensitive that the indicator shows a tuning error of 1 part in 10,000 Price: £61

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AM TUNER

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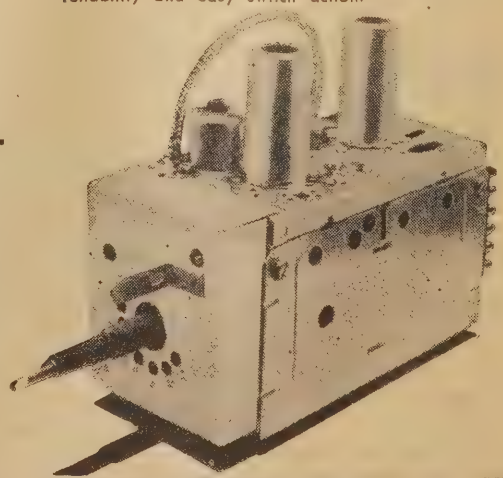

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FROM THE SERVICEMAN WHO TELLS

Why is it that, after several generations with electric power in our homes, there still are sections of the community who cannot learn how to live with it? Power need not be feared, but it must be respected and this respect is something these people have never learned. One of my stories this month demonstrates this quite forcibly.

BUT first I would like to comment on a letter passed on to me by the Editor, which takes me to task for some of the comments I made in the February issue. The relevant portion is reprinted in the accompanying panel, and I suggest you put yourself in the picture by reading it before going any further.

The first point my correspondent makes is that I believe ". . . that many members of the public are trying to rob the people that provide service to them."

I don't know about "many" members of the public falling into this category, but substitute the word "some" in that sentence and I'll plead guilty to that point of view. The reason is simple. Years of experience have taught me that there is always a percentage of the public —small, admittedly, but quite definite— who regard a repair man as "fair game."

FREE ADVICE

On the pretext of seeking your services, they will obtain all the free advice they possibly can, then sneak off and spend their money elsewhere—usually at some so-called "wholesale" establishment —on the basis of this advice.

I have even known some who were brazen enough to come back and boast to me of how they were able to repair their set so much cheaper than the price I quoted; completely forgetting — or ignoring—the fact that they were able to do this only because they had the benefit of my advice; and that I was able to give advice only by reason of a background of training and experience extending over many years.

Further that they had spent time chasing replacement components and that time is a commodity which a serviceman has to charge for.

In the circumstances, it is not surprising that one gets a little hot under the collar when someone tries this trick.

Nor is the radio serviceman the only victim. Ask any motor mechanic, electrician, plumber, or other appliance repair man and they will all tell of similar customers; not in great numbers, perhaps, but enough to make them wary and usually able to spot the type when they see them.

CUSTOMER COMPLAINTS

In defence of the customer, A.D.F. relates cases where the latter has been the victim of incompetence or (apparently), overcharging, though I am not quite sure what this is supposed to prove.

When such cases do occur—and I do not doubt their existence for one moment—I am all on the customer's side. In fact, reference to earlier articles will show that I have nothing but contempt for dealers and mechanics who deliberately mislead the public in an effort to add a few more pounds to the bill or to cover up their own incompetence.

However, we first must be perfectly sure that such incompetence or dishonesty really exists. While there would, for example, be little doubt about the incompetence of a mechanic who charged a battery back to front, there is considerable doubt as to any dishonesty associated with a £1/1/ service charge for repairs to a washing machine in the home.

It would be quite easy to justify such a charge in many cases simply on travelling time and expenses alone and I would strongly repudiate the possible implication that the job should have been done for nothing.

In any case, I cannot see that these stories have much bearing on the original theme about which A.D.F. complains. Two wrongs seldom make a right, and I don't imagine that A.D.F. believes, any more than I do, that they justify such customer tactics.

In short, I feel that it is a very good thing for someone to comment on dishonest business tactics whenever they are encountered, regardless of whether they involve the dealer or the customer. I have tried to do that in a completely impartial manner, in the hope that our next generation of servicemen may, on the one hand, be warned of some of the customer difficulties they may encounter and, on the other, be inspired to aim at a higher standard of competence and integrity.

A MATTER OF CHARGES

My first little complaint is about what I would call the general impression I got from the first half of an article by The Serviceman Who Tells in the February 1959 issue.

The impression I get is that the writer believes that many members of the public are trying to rob the people who provide service to them, ("taken for a mug" was the term used). Incidentally couldn't this kind of crude language well be left out of a technical book?

I have worked in a department that has a good many contacts with the public and I just "won't buy" this point of view at all. Recently a neighbour of mine had his car battery charged very carefully back to front by the local garage.

A few weeks ago I read in the Sydney "Sun" of a lady who bought a washing machine and had it out of order after a short time, called the service department, who sent a man out, and the service charge was £1.1.0 just for fixing the screw in the power plug.

A little further on in the article the Serviceman Who Tells says that after the nut and lockwashers on the vertical hold, horizontal hold, and contrast potentiometers had been properly tightened it was then likely that they had been loosened by some of "mother's little darlings" just by twiddling the knobs, well I won't buy that one either, I'd like to see it done.

(Signed) A.D.F.
Pennant Hills, N.S.W.

NASTY WORD?

There is also the objection to my use of the word "mug." I'm sorry about that because I felt that it was sufficiently a part of our Australian idiom to be accepted as a useful descriptive term and one for which there may not always be an exact equivalent. Frankly, while giving full consideration to A.D.F.'s point of view, I find it difficult to understand why he finds it so objectionable.

Finally, A.D.F. expressed doubts that children would be able to loosen a group of controls by excessive fiddling. My friend, when you have been repairing radio sets as long as I have, you'll be prepared to believe anything, no matter how improbable it may seem.

Looking at it objectively, I suppose the whole thing boils down to a matter of opinion; I gave it as my opinion that this is what happened, while A.D.F. gives it as his opinion that it couldn't happen.

The main difference is that I listed several facts to support my opinion, while A.D.F. simply says he doesn't believe it. The facts I presented were, briefly, as follows: (1) the fact that the controls had obviously been screwed up tight when the set was made, (2) the owner denied that he was responsible, and (3) the general demeanour and behaviour of the offspring as I saw them.

Yes, it was only an opinion, but, oh, brother, I wish I was as sure of the lottery!

Anyway, many thanks for your letter, A.D.F., and the comments you expressed. You may be sure I value them, even if I don't necessarily agree with them.

HARD TO BELIEVE

My first story this month also may tax the credulity of my more sceptical readers (including, perhaps A.D.F. himself). Fortunately, it is more a matter of fact than of opinion, plus the fact that I was fortunate in having a colleague witness the phenomenon and was able to photograph it for all to see.

The set concerned was a mantel type which a lady had delivered to the shop the day before, with the simple explanation that it was completely dead. Beyond noting the nature of the complaint and the fact that the cabinet was of rather unusual styling, I had not taken a great deal of notice of it. Being

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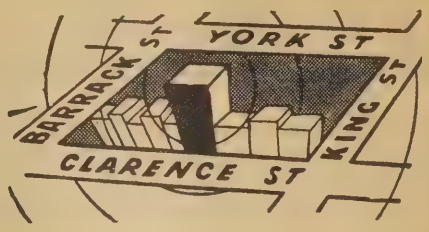

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rather busy I had simply pushed it on to the "IN" shelf to await its turn.

When I did get around to examining it more closely I realised why it had appeared a little strange at first glance. It was an imported model, of English origin, and thus of a style not normally seen in this country. However, I imagined it would not present any special problems.

The next point I noticed was that the back of the cabinet was almost completely enclosed with a light composition panel, which, together with the fact that the whole thing seemed rather light for its size, immediately aroused my suspicions. Was it an "AC-DC" or "transformerless" set?

It was, indeed, and the maker had very thoughtfully provided a warning plate on the back to this effect. This was all very well except for one point. The warning plate was of metal and was mounted on the chassis rather than the rear panel. Thus, in order to make the warning plate visible, part of the composition panel had had to be cut away, exposing a substantial area of (potentially) live chassis!

A STORY

The set-up reminded me of a very old gag, which may be new to some and which I feel is worth telling, anyway.

It seems that a rather inquisite gentleman was walking along a strange street one night when he was confronted by a sign mounted high up on a post. Being unable to read it from the ground in the poor light he shinned up the pole schoolboy-fashion, struck a match, and read the message—"WET PAINT."

In short, the very presence of the warning sign was in itself a hazard.

But this was not all. On the back of the chassis were two cheese-head bolts used to hold some part of the assembly inside the chassis. With the protective panel mounted hard against the rear of the chassis it had been necessary to provide a substantial cut-out in the panel to accommodate them. Since the bolt heads were as thick as the panel there was virtually no protection here either.

Finally, there were four more similar bolts used to hold the protective cover in place. Two, in the two top corners, were harmless enough, since they screwed into metal inserts, led into the wooden cabinet. The lower two, however, screwed straight into the chassis with their heads protruding beyond the line of the cover by their own thickness plus that of a metal washer.

PLENTY OF METAL

Thus, there were four bolt heads and a warning plate in intimate contact with the chassis and clearly exposed to the fingers of anyone handling the set. I found myself wondering why they had bothered to provide a protective cover at all, in view of all the gaps in it.

A check with an ohm meter showed that there was no direct connection between either side of the mains and chassis but, with power applied, it was possible to read nearly the full mains voltage between chassis and earth, suggesting the presence of a capacitor between some part of the power line and chassis. This is a normal arrangement with most sets of this kind.

Just how dangerous the whole set-up was may be a matter for debate. In defence of the designer it must be granted that (1) the impedance of the above-mentioned capacitor normally would be high enough to limit the flow of current to a safe value, and (2) that no part of the exposed metal work was in a form which would allow it to be grasped in the event of involuntary muscular contraction.

On the other hand, capacitors can break down and, should this happen, the chassis could be in direct contact with the live side of the mains. In any case, even with the capacitor intact, it still was possible to receive an unpleasant shock from the chassis, certainly violent enough to cause one to drop the set if caught unawares.

I formed the impression that the set-up, if not actually dangerous in the worst sense, was at least a highly undesirable arrangement, capable of delivering an unpleasant shock to an unsuspecting user. In short, not a particularly good design from this point of view.

It was while I was musing thus that a colleague poked his head through the workshop door, passed the time of day, and invited himself in for a technical discussion. (His name for a yarn.)

Quite naturally, I was rather glad of the opportunity to point out to him all the shortcomings I had just discovered, and to note his reaction to them. However, in the middle of my discourse I suddenly realised that his attention seemed to have wandered; that he was, as they say, no longer "with me."

ANOTHER HAZARD

He was no longer looking at the back of the set as I pointed out the various exposed portions, but seemed to be concentrating on something on the floor. Judging from the pop-eyed expression on his face I realised it was something of more than ordinary importance.

"Never mind the receiver faults," he exclaimed, "have you seen this?"

He stooped and picked up a bundle of the receiver power cord as he spoke —it was quite long and I had left most of it bundled up as it had been when I received the set—and pointed to a section of cable in the middle of the bundle.

"This" was a joint where an extra length of cable had been added to the original, and we both stood and stared at it with a mixed sense of disbelief and something akin to horror.

The cable was ordinary twin plastic flex ("figure eight" style) and, whoever had joined the new length had simply removed the plug, bared the two ends of the new section and twisted the respective wires together. Just that and nothing more. No attempt of any kind had been made to insulate the bare wires either from each other or anything else—they were just sitting there, connected directly to the mains, waiting for someone to make contact with them.

Apart from the potential danger of the set-up, the point which intrigued both of us was the fact that the two wires had never managed to get close enough together to short circuit, though they must have come very close to it at times. In fact, the only thing which apparently prevented it was the natural spread of the two wires where they had been split prior to joining. Most of the time there was not more than a quarter-inch between them.

Sensing a story, I lost no time in setting up the camera and photographing the joint exactly as we found it, and it is reproduced herewith for all to see. As a "horrible example" of a potential death trap, it must surely take the prize. My colleague summed it up very effectively, I thought, when he said quietly.

"I wonder if they've got any kids?"

Picture of a death trap. These leads carried 240 volts AC.

After this, the fault in the set proper turned out to be little more than routine. Removing the back revealed one valve with a characteristic white coating on the inside of the glass; a clear sign of air entering the envelope by some means.

It turned out to be the rectifier and further confirmation of its failure was provided when I switched the set on. Not only did it refuse to deliver any H.T. voltage, but the filament also refused to light, in spite of the fact that it was intact electrically.

In the normal way it would have been a routine job to replace it, but it was a rather unusual type. Designated as a UY41 it is a half-wave rectifier with a 100mA heater for use in series heater network of this kind. It is a miniature type, having an unusual base and socket officially described as a "European 8-pin miniature (Rimlock)."

SPECIAL ORDER

I had no such valve in stock, of course, but I was fairly certain that a few, at least, had been used locally and replacement stocks should be available. Sure enough a phone call confirmed this, and I placed an order right away.

When it arrived a couple of days later I plugged it in, switched on, and the set came to life and performed perfectly. As far as I could find there was nothing else the matter with it.

When the lady came to collect the set I tried to learn something about how the potentially lethal joint in the power cord had come into existence. Unfor-

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TYPE OP387

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SPECIFICATION

PRIM. IMP. .. .. 8000 ohms P.P.

SCREEN TAPS .. .. 18.5% of plate imp.

SEC. IMP. .. .. OP387-15 — 15 or 3.75 ohms
OP387-8.4 — 8.4 or 2.1 ohms

NOM. POWER RATING .. .. 12 watts

FREQ. RESPONSE .. 20-100,000 c.p.s. plus or
(Attainable) Minus 1 db. (at 10 watts)

POWER RESPONSE .. 30-50,000 c.p.s. plus or
(Attainable) minus 1 db. (at 1 watt)

PRIM. D.C. RESIS. .. .. 90 ohms (each half)

MAX. PRIM. D.C. .. .. 80 mA (each half)

SEC. D.C. RESIS. .. Less than 6% of sec. imp.

PRIM. INDUCTANCE .. .. 160 henries
(10V 50 c.p.s plus 5 mA unbalance)

LEAKAGE INDUCTANCE .. .. .. 7 millihenries

PRIM. FUND. RESONANCE .. .. 140 Kc.

INSERTION LOSS .. .. .. LESS THAN 1 db

Fitted with vertical mounting covers finished in standard FERGUSON Silver-Grey Hammertone, with laminations in black. Packed in strong carton with complete data sheet.

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TYPE PF1412

As specified for the "Playmaster 10W Stereo Amplifiers" (R.TV & H., Jan. 1959) to supply amplifier and tuner etc.

PRIMARY—230, 240V 50 c.p.s.
H.T. SEC.—300-0-300V 200mA
L.T. SEC.—6.3V—3A, 6.3V—3.5A C.T., 5V-3A

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OC 16 TRANSISTOR TRANSFORMERS

TYPE TRD 117 TYPE TRS 105

Designed for use in the amplifier described in Philips Miniwatt Journal Vol. 1, No. 2.

TRD 117	TRS 105
PRIM.—420 ohms C.T. SEC.—105 ohms C.T.	PRIM.—33 ohms C.T. SEC.—15 ohms

Two amplifiers are described by Philips, for 500 milliwatts and 10 watts output. The correct FERGUSON transformers for each amplifier are listed below.

500 mW.	10 Watts
T1—TRD 108 T2—TRS 107	T1—TRD 108 T3—TRD 117 T4—TRS 105

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TYPE PF 1387

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The transformer is an auto type and connects between the 6.3V heater line and the picture tube heater.

PRIM.—6.3V 50 c.p.s.
SEC.—7V, 8V or 9V-1A

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tunately she could tell me very little, since it was not even her set, belonging to an elderly relative for whom she had undertaken the job of having it repaired.

So I had to content myself with a brief lecture on how dangerous it had been, and hope that it might find its way back to the person concerned.

In the meantime I am still trying to understand how anyone in this day and age could be so woefully ignorant of elementary electrical principles as to be unaware of the danger of bare power cables.

My next story also concerns a mantel set, but this time a local model of fairly recent design. It also was brought to me by one of the fair sex and her request was mainly to get some idea of the condition of the set, whether any repairs were necessary, and what they might cost.

She went on to explain that it was an item from a deceased estate which was being broken up and sold, that she had an opportunity to buy it, but that she would like to know something of its condition before deciding on whether the suggested price was a reasonable one. She added, somewhat as an afterthought, that it was inclined to distort after it had been running a little while.

RISKY JOBS

In the normal way I am not particularly keen on jobs of this kind. There is a limit to the extent to which one can determine a set's condition or forecast how long before a failure is likely to occur. Even determining existing faults can be embarrassing in such cases, because finding a fault is often synonymous with fixing it and it is then difficult to make an appropriate charge when the customer decides that too much money is involved and he doesn't want the job done anyway!

However, this looked to be a case where I could take the risk. The set was a reasonably new model, it seemed to perform quite well (apart from the distortion) and I reasoned I should be able to give it a "once-over" without wasting too much time.

From the description of the distortion and the manner of its onset I suspected a grid current condition in the output valve (a 6M5). Listening to the set on the bench strengthened this impression, the reproduction starting off perfectly clean, then commencing to distort almost imperceptibly after several minutes and finally building up to a quite severe condition.

With the chassis out of the cabinet and upturned on the bench I checked the grid of the 6M5 with the multimeter. Sure enough, there was a small but definite positive reading on the meter, a clear indication of the type of trouble I suspected.

POSSIBLE CAUSES

There are normally two possible causes of this effect: a leaky coupling capacitor from the previous stage allowing the grid to be driven positive, or a gassy valve. In either case the cure is obvious.

To clarify the point I first lifted one end of the coupling capacitor from the circuit and checked the grid voltage once again. The positive reading was still in evidence, so I immediately assumed that the valve was the culprit.

Removing it from the socket I put it to one side and reached for a new one, only to be confronted with an empty shelf. Then I realised that a run on this type in the last couple of days had caught me unawares and that the next delivery was not until the following day. It seemed that I would have to put this job aside for the present.

Turning the chassis right side up, preparatory to putting it on the shelf, the top of the empty 6M5 socket caught my eye and, in particular, a grey mark between two of the holes. Glancing at the underside of the valve I found a similar, though not quite so obvious, smear of "something," and between the same two pins.

Then I realised that the pins involved were Nos. 1 and 2 and, if my memory was not playing tricks, these were the screen and control grids respectively. When a quick check confirmed this I began to wonder if this "foreign matter" —whatever it was—could possibly have sufficient conductivity to cause the trouble: allowing positive voltage on the screen to reach the grid.

Closer examination of the socket failed even to suggest what the substance was but it wiped off cleanly with a drop of carbon tet., and there appeared to be no damage of any kind to the socket.

I cleaned the valve similarly, pushed it back in the socket, and switched on. The set warmed up and played cleanly as before, but it kept on playing cleanly and, at the end of 10 minutes, with no sign of trouble, I began to feel hopeful. After another 10 minutes with everything going well I considered the point proved, even though I left it playing the rest of the afternoon as a double check.

And what was the substance and how did it get there? That, I'm afraid, must remain a mystery. The most likely explanation would seem to be that it was some kind of grease—as might be used on the dial mechanism for example—which had found its way on to the socket during some stage of original assembly.

DUST AND DIRT

At this stage, being reasonably pure, it probably caused no trouble but, with the passing of time, it would accumulate small particles of dust and dirt. These would, in turn, absorb moisture and eventually produce some kind of conductivity path between the two pins. Even if this amounted to many megohms it still could rob the grid of some of its bias.

Once this happened the plate and screen current would rise, the plate and screen dissipation rise, and any tendency to grid emission aggravated. Then the valve would be on the verge of the well-known runaway condition which can even finish up with it completely wrecking itself.

And all—presumably—because someone was rather careless with their greasy fingers while handling the set during manufacture.

The rest of the set appeared to be in quite good condition. The valves tested o.k., the alignment was within a whisker, there were no electrolytics which looked as though they were about to spill their inside outside, the dial worked smoothly, and there were no noisy controls.

With these points checked I felt that I had gone about as far as was practicable in assessing the receiver's probable performance and value. In general I felt that the set was in good condition with many years of useful life ahead of it. I advised the customer accordingly and suggested that it was well worth the price which had been put upon it.

As a result, she was able to buy a good set at an attractive price, the executors of the estate were able to dispose of one more item, and I collected my modest fee.

So everyone was happy.

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SPECIMEN ANSWERS—AOCP EXAM

Here is a set of answers to questions set in the quarterly examination for the Amateur Operator's Certificate of Proficiency held in January, 1959 which we think would have gained high marks. The time allowed was 2½ hours, and seven questions only were to be attempted.

QUESTION:

1. (a) Explain, with the aid of a diagram, how you would operate on 14050 kc/s when using a crystal oscillator on 7025 kc/s, a triode intermediate stage and a tetrode power amplifier.

(b). Is it necessary to neutralise the intermediate stage? Give reasons.

ANSWER:

(a). The diagram shows a simplified circuit for a transmitter which meets the requirements. V1 is connected as a straightforward crystal oscillator operating on 7025 Kc, the crystal being ground to this frequency. R1 is the grid bias resistor, usually 50 or 100K. The plate coil L1 is tuned to approximately the same frequency as the crystal—in practice a little higher—by means of C1. Positive feedback via grid plate capacitance causes the circuit to oscillate.

The second stage is operated as a frequency doubler. The grid bias is developed across resistor R2, generally between .025 and 100K. The bias is higher than normally used when the valve is a straight amplifier.

The plate circuit of V2, L2 and C2, is tuned to 14050 Kc. and is coupled to the plate circuit of V3. Once again there is a grid bias resistor, which may be between 12 and 25K, according to valve type and service. Some cathode bias is provided as a safety precaution, and the screen is connected to its appropriate high tension voltage. This could also be sufficient for the triodes. The plate circuit, C3 and L3, of V3 is tuned to 14050 Kc. and coupled to a suitable output circuit.

The RF chokes in series with the grid resistors are optional.

Almost any type of triode is suitable for a crystal oscillator, but for preference both V1 and V2 should be high-transconductance types. V3 will be selected according to output power required.

(b) It is not necessary to neutralise the intermediate stage. When both plate and grid circuits are tuned to the same frequency, there is usually enough positive feedback through the internal capacitance of a triode to cause oscillation. But when the plate circuit is tuned to a multiple, there is no energy at the frequency of the grid circuit to provide this feedback, and the valve will not oscillate from this cause.

☆ ☆ ☆

QUESTION:

2. A receiver for use on the 14 Mc/s amateur band is found to exhibit the following characteristics:—

(i) Both the desired signal and an undesired image signal are received simultaneously.

(ii) Signals on a channel adjacent to that to which the receiver is tuned are reproduced.

(iii) All received signals are modulated by A.C. ripple.

Discuss probable causes and means of reducing each of these effects.

ANSWER:

(i) This effect is caused by the signal circuit selectivity ahead of the converter valve being insufficient to reduce its response at the image frequency. This occurs at a frequency twice that of the intermediate frequency higher or lower than that of the signal frequency, according to whether the oscillator is tuned to the high side or the low side of the signal.

The effect may be reduced by

(a) Increasing the number or selectivity of the tuned circuits ahead of the converter.

(b) Using an intermediate frequency high enough to locate the image further away from the signal so that the tuned circuits ahead of the converter can reject them.

(c) Using a double superheterodyne with a high first intermediate frequency, which is a variation of (b).

(ii) This effect is caused by the selectivity of the intermediate frequency being insufficient to reject the unwanted signals . The selectivity of the signal frequency circuits is usually of negligible importance in such a case.

The effect may be reduced by (a) improving the selectivity of the intermediate amplifier by adding further tuned circuits, (b) by using higher selectivity IF transformers, (c) by using a lower IF which generally provides best selectivity.

(iii) This effect is caused by insufficient filtering in the power supply, particularly that section feeding the RF oscillator or oscillators. It may also be caused by insufficient shielding between the primary and secondary windings of the power transformer, giving rise to "modulation hum."

The effect may be reduced by

(a) Improving the filtering, including voltage regulation of the oscillator feed point if necessary.

(b) Using a power transformer with an efficient electrostatic shield between primary and secondary, or which has a high-voltage capacitor of between 250 and 1,000 pf from each side of the mains to earth.

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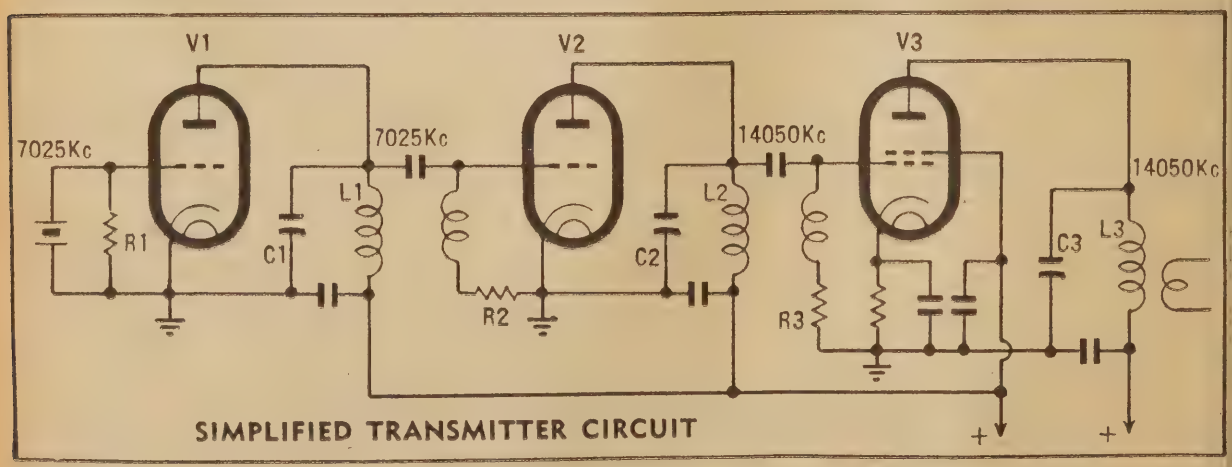
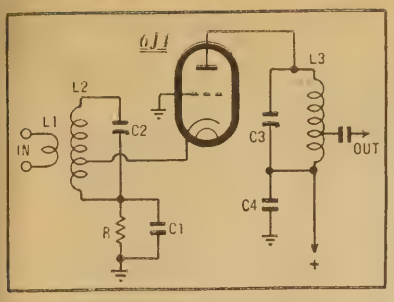
QUESTION.

3. Draw a circuit diagram and explain briefly the theory of operation of a grounded grid radio frequency amplifier for use in a receiver operating in the V.H.F. range. What are the advantages of this type of amplifier compared with normal types operating at similar frequencies?



For question 1: A typical transmitter circuit



Question 3: A grounded-grid RF amplifier.

ANSWER:

Grounded grid amplifiers are used on VHF at frequencies where pentodes are no longer practicable and triodes must be substituted. The grid is connected to earth, shielding the plate from the cathode so that there is ideally no capacitive coupling between them. As the grid is no longer available for application of the input voltage, this is connected to the cathode, the output circuit being connected to the plate.

Used in this manner the valve has almost the same amplification as in grounded cathode connection, but the input resistance of the cathode circuit is very low. This is due to a feedback action caused by the fact that voltages across the cathode circuit, now the input circuit, must also appear in the plate circuit which is the output circuit. The difficulty of coupling this low impedance to the input circuit limits the amplification which can be realised from the entire stage, so that it is much less than that of a grounded cathode connection.

To obtain highest gain and greatest stability from a grounded grid amplifier, high gm valves are desirable, and special constructional methods represented by the "lighthouse" valves, for instance, are often used to obtain the least possible coupling between input and output circuits. As a rule two grounded grid stages are needed to approximate the gain of a single neutralised triode amplifier.

In the circuit shown, L1, L2 and C2 comprise the input circuit, L3 and C3 are in the output circuit. The cathode is tapped near the bottom of L2 to match the aerial impedance. Cathode bias is supplied by R. C1 and C4 are bypass capacitors. The grid is earthed.

The advantages of the grounded grid amplifier are (i) that it allows low-noise triodes to be used without neutralisation, which becomes very difficult at the highest frequencies and adds to the effective input and output capacitances of the valves, (ii) it is comparatively stable, (iii) easy to adjust and (iv) it is particularly adaptable to the wide band tuning circuits.

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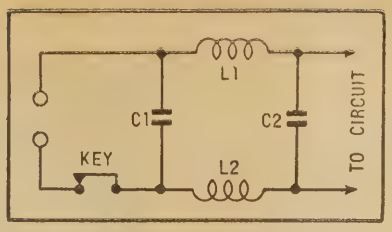
QUESTION:

4. (a) What are the causes of "key clicks" and "blanketing"? (b) Explain, with the aid of diagrams, how interference to broadcast reception which is caused by key clicks from a transmitter operating on 7 Mc/s may be reduced or eliminated.



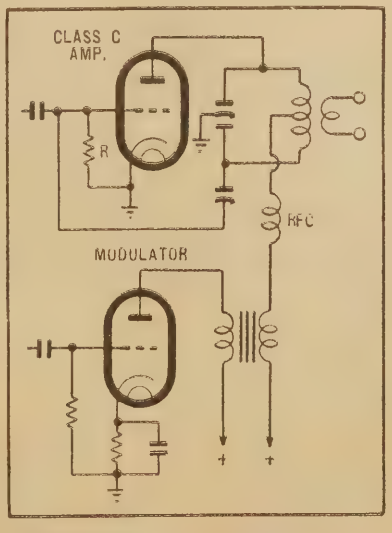
Question 4: A key-click filter.

ANSWER:

(a) Key clicks are the result of spurious radiations from a transmitter caused by breaking and making the carrier too rapidly. When this happens, high transients are produced and radiated which are detectable on each side of the carrier and for a considerable distance away from it. If severe, they can be heard in nearby receivers including broadcast receivers.

Blanketing is an effect noticed when attempting to receive in the vicinity of a transmitter whose field strength is sufficient to partly or completely paralyse the receiver. This effect can take place even when the frequencies concerned are widely separated, although it becomes worse when they are the same.

(b) Key clicks which interfere with broadcast reception can be reduced or eliminated by inserting a simple filter circuit, effective over the band of click frequencies, which increases the fraction of time taken for the transmitter carrier to rise and decay as the key is operated. The standard filter is shown in the diagram, and consists of appropriate values of capacitance and inductance connected in the leads of the key C1 and C2 may be from about .01 to .001 mfds, and L1 and L2 are RF Chokes of 1-2.5 mh. Often experiment is necessary to select the best values.



Question 5: Plate-modulated Class-C amplifier.

QUESTION:

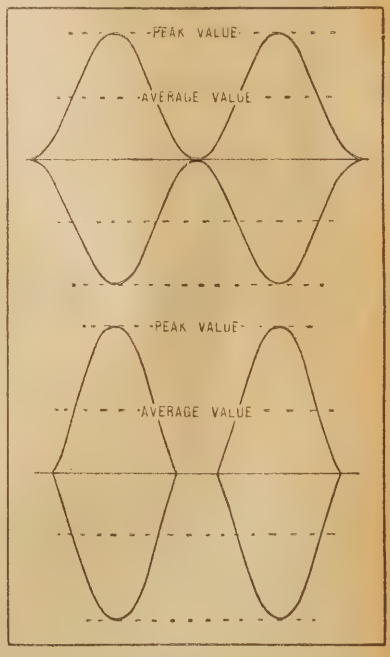
5. Describe fully the theory involved in amplitude modulating a class "C" R.F. amplifier using anode modulation. What are the results of over modulating the stage? Use diagrams to illustrate your answer.

ANSWER:

The diagram shows a simplified class "C" triode amplifier, neutralised, plate modulated by a transformer coupled audio valve.

The operating conditions for a class "C" modulated amplifier provide that it shall be biased by at least twice the amount of voltage required to cut off the plate current. This bias is generally supplied by rectification in the grid circuit caused by applying sufficient driving voltage to the grid. The flow of grid current through the grid resistor R causes a voltage drop which is the bias voltage. External bias supplies can be used, as well as cathode bias. Because of its self-regulating action, grid leak bias is preferred at least for portion of the bias voltage.

Because of the high bias, plate current flows over only that portion of the



Question 5 Illustrating (top) a fully modulated carrier and (below) the effects of over-modulation.

driving cycle during which the RF voltage applied to the grid is sufficient to allow the valve to conduct. Adequate driving voltage is essential for a class "C" amplifier and must be sufficient to maintain the correct flow of grid current, which is a check upon it.

The modulator in this instance is connected to a transformer which matches its required output impedance to that of the amplifier and super-imposes any audio frequency voltages in its plate circuit upon the voltage already applied to the amplifier.

Thus when the audio voltage is moving in a positive direction, it is added to the amplifier applied voltage, and

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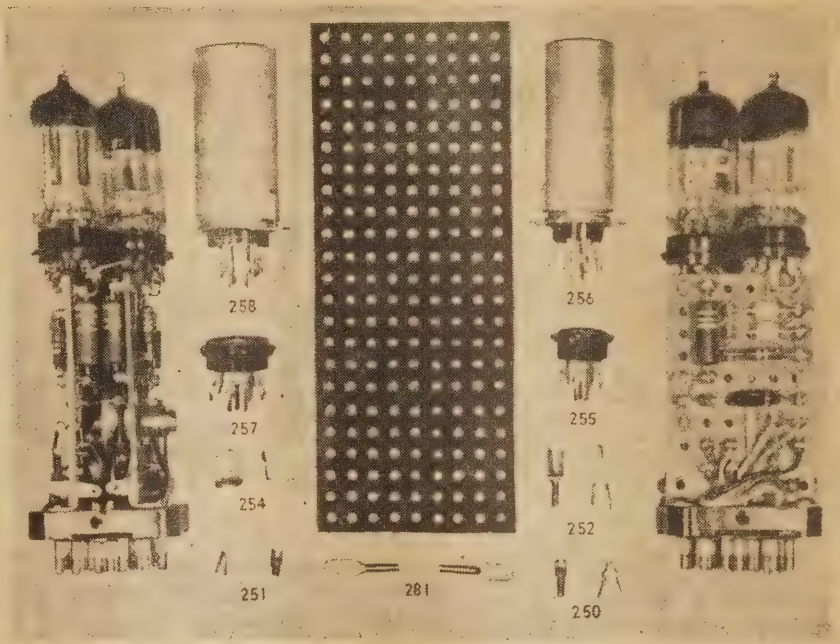

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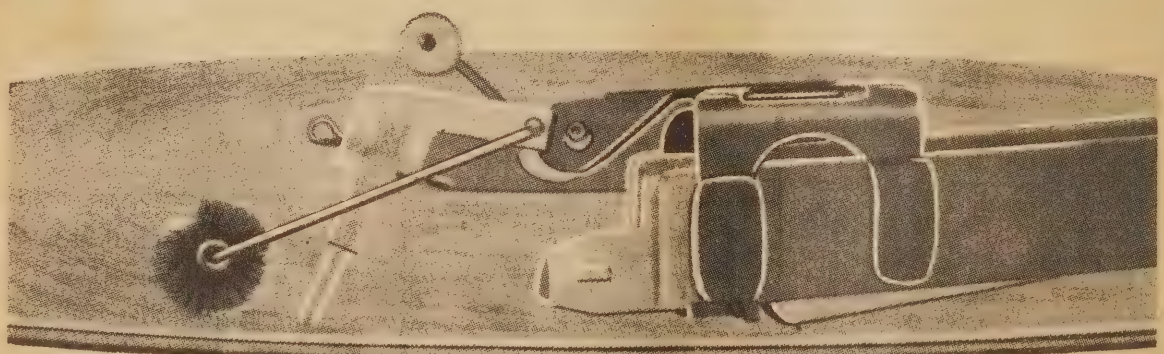

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when it is moving in a negative direction, it is subtratcted from it.

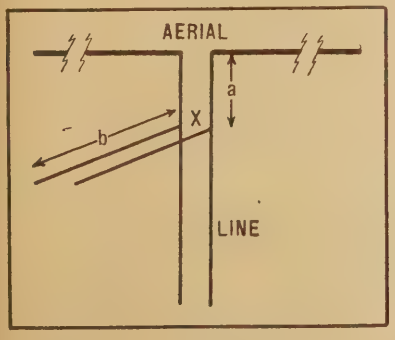
The modulator should have the capacity of providing an audio frequency voltage sufficient to reduce the instantaneous plate voltage on the amplifier to zero on the one hand, and increase it to twice its original figure on the other. When this occurs, the amplifier is modulated 100 per cent.

Because the voltage of the amplifier is varied in this manner during modulation, its instantaneous plate current will vary also, becoming zero when the voltage falls to zero, and rising to twice its value when the voltage has doubled. For this reason the instantaneous power of the transmitter increases four times on modulation peaks.

If the amplifier is correctly adjusted, the average value of both plate voltage and current remains unaltered during modulation, as their increase and decrease to the maximum instantaneous values will be exactly the same in amplitude throughout each cycle. In other words, the modulation characteristic will be linear.

In order to sustain oscillations in the output circuit during that period when grid current is not flowing, the ratio of its inductance and capacitance should be selected so that the circuit has a Q when loaded of approximately 12.

The modulator has to supply sufficient power to swing both instantaneous plate voltage and current of the amplifier to twice its original value. As the RMS value in each case will be .707 of the instantaneous value, the audio power required will be 50 per cent of the average amplifier plate power input.



Question 6: A matching stub.

Overmodulation of the stage occurs when the negative excursions of the plate current and voltage are so great that the valve is cut off for portion of the operating cycle. On the positive cycle, the plate voltage and current, within reason, will continue to increase, and the instantaneous power output at this point will increase also. On the negative excursion, however, spurious radiations can take place due to the sudden cessation of the carrier, resulting in splatter and possible interference due to the radiation of unwanted transients. At the same time the average plate current and voltage will increase as a result of the higher values reached on the positive cycle, assuming the peak emission of the valve and the driving power available are sufficient. The amplifier will then no longer be operating in a linear fashion.

QUESTION:

6. What is meant by matching stub? Discuss the theory involved.

ANSWER:

When a transmission line is connected to an aerial at a point having an impedance different from that of the line, a mismatch will occur which can be corrected by connecting a matching stub across the line at a suitable point near the aerial. The stub is a length of line having the same characteristic impedance as that of the transmission line used.

A correctly matched aerial system will exhibit a purely resistive component along the line and at the feed point. But if a mismatch occurs, standing waves will appear along the line and a reactive component will be introduced.

This means that the line will no longer have a constant impedance along its length, as both current and voltage distribution will vary to a degree determined by the degree of mismatch.

As a consequence, there will be a series of points along the line at which the resistive component is equal to the nominal line impedance, but at which there will also be a reactive component due to the mismatch.

If at such a point, a reactance of opposite sign but equal value is connected across the line, it will cancel the reactance already there, and the point will become purely resistive, as will the entire line from the point of attachment back to the transmitter.

By calculation or reference to published charts, a short length of transmission line can be determined which will represent such a reactance, and this length of line when attached becomes the matching stub. In practice, the point of correct impedance nearest the aerial itself is selected as the point of attachment, in order that the greatest possible length of transmission line will be correctly matched, and free from the losses which are caused by standing waves.

Stubs can be either open or closed at the free end, depending on the type of reactance required to procure the correct match.

The diagram shows a transmission line connected with a mismatch to an aerial. Point X is the nearest point to the aerial at which a resistive value is found equal to that of the line, but having an additional value of reactance. The matching stub B, in this case an open stub, is of such a length as to introduce a reactance of equal value but opposite sign to that found at point X. The line will now be correctly terminated at X. Critical dimensions are A and B, the stub length and the distance of point X from the aerial.

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QUESTION:

7. With the aid of sketches, explain fully the construction and principle of operation of a meter suitable for measuring radio frequency currents.

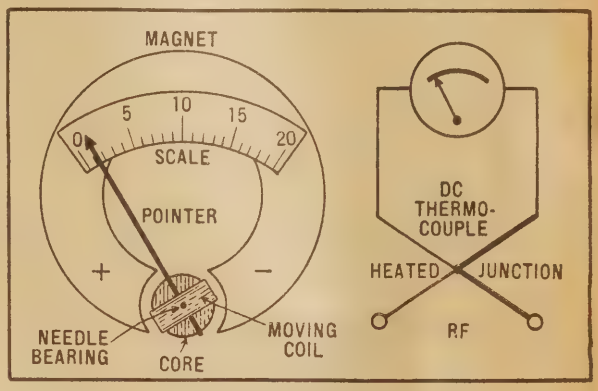
ANSWER:

It is not generally practicable to measure RF current directly. Most methods use portion of the RF energy involved to produce heating effects which operate thermo-electrical devices such as the hot-wire ammeter or the thermo-coupled meter.

The thermo-coupled meter is generally the most accurate and universal.

It consists of a moving coil d'Arsonval type meter operated by the output of a thermo-couple connected to the transmitter output or inserted in series with a feedline, as the case may be.

The thermo-couple consists of a junction between two dissimilar wires, one in each side of the circuit. When a current of any kind is passed through one half of the thermo-couple so that the junction is heated, a direct current will flow in the other half. If a suitable meter is connected to the thermo-couple, and the heating current supplied from the RF output of the transmitter, the meter will indicate a reading related to the amount of heat supplied to the junction, and hence to the amount of RF energy being supplied by the transmitter.



Question 7: The principle of an RF thermo-ammeter.

The moving coil meter has a magnet assembly in which there is a gap to allow the mounting of a coil of insulated wire connected to a pointer. Both are mounted on a spindle supported in needle bearings, and supplied with check springs which allow the pointer to move freely, but restore it to its reference point when it is not in use.

When a current is passed through the coil, the lines of force set up around it interact with those of the magnet assembly, and cause the coil to rotate in the same manner as the armature of an electric motor. Its movement, which is substantially linear, over the working range is directly proportional to the amount of current flowing through it.

Although the meter itself is linear, the amount of current produced by the thermo-couple is proportional to the power of the heating circuit, for the heating effect of the junction is proportional to the square of the current. As a result, the low readings of the meter

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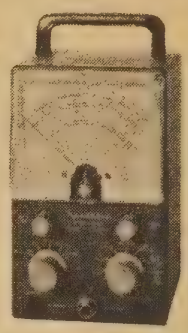

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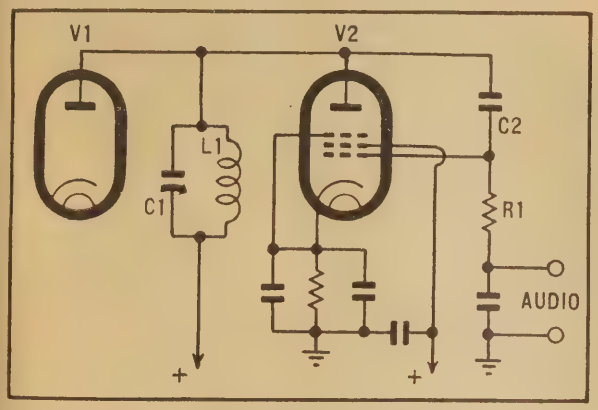
QUESTION:

8. With the aid of a circuit diagram, explain the theory of operation of a reactance modulator suitable for use in a frequency modulated transmitter.



Question 8: Illustrating the basic principles of a reactance modulator.

ANSWER:

Frequency modulation is obtained by causing the frequency of an oscillator to vary from its nominal value in proportion to the instantaneous value of an audio signal supplied to the modulator valve.

Variation of frequency is obtained by varying the effective inductance or capacitance which together make up the frequency determining circuit of the oscillator. If then, a modulator valve is connected to this circuit in such a way as to represent a variable capacitance or inductance, which may be changed in value by applying an audio voltage to its control grid, it will frequency modulate the oscillator in proportion to the amplitude of the modulating signal.

The circuit shows a typical reactance modulator connected to the tank circuit of the oscillator. The plate current of both valves flows through the tank circuit, so that a change in the current flow of the modulator is able to affect the characteristic of the tank.

Now, in order for the tube to appear as a variable reactance across the tank, it plate circuit must contain an RF component in which there is a phase difference between the voltage and current.

This difference is initiated by the capacitor C2, connected from the plate to the grid of the modulator, in which there is a phase change of 90 degrees, as is normal with capacitors, the current leading the voltage.

This condition is maintained in the modulator plate circuit so that, instead of a pure resistance, the modulator valve now appears as a reactance in parallel with the tank circuit, and will change the former frequency of the oscillator in proportion to the value of its reactance.

To operate the modulator, an audio voltage is applied to its control grid. Because any change in grid bias will change the valve's transconductance and, therfore, its instantaneous plate current, the value of the reactance it represents across the tank circuit will increase or decrease in proportion to the instantaneous value of the modulating voltages on the grid.

This change in the value of the reactance varies the frequency of the oscillator, again in similar proportion, and the oscillator is therefore frequency modulated.

The amount of frequency change is called the frequency deviation, the ratio between the frequency deviation and the modulating frequency is called the modulation index, and the ratio of the maximum frequency deviation to the highest modulating frequency is called the deviation ratio. For maximum efficiency the maximum deviation should not exceed the bandpass limits of the receiver.

In the diagram VI is the oscillator valve, and C1-L1 the tank circuit. V2 is the modulator, and C2 the feedback capacitor in which the phase change occurs. The amount of RF voltage applied to the grid is determined by the valve of C2. R1 the resistance of which is much larger than the reactance of C2, and the input capacitance of the valve to earth. The modulator cathode is bypassed both for audio and radio frequencies.

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QUESTION:

9. A triode power amplifier valve has a total cathode current of 180 milliamperes when a 400 ohm cathode resistor is employed. The grid current is 20 milliamperes and the H.T. supply is 800 volts. Calculate (i) the D.C. input power to the anode of the valve and (ii) the grid bias voltage developed across the cathode resistor.

ANSWER:

(i) The D.C. input power equals EI. where E is the number of effective plate volts and I the number of plate current amperes.

As the total cathode current is 180 milliamps and the grid current is 20 milliamps the plate current must be 160 milliamps, as there is no other electrode which uses cathode current.

As there is a 400 ohm cathode resistor through which a current of 180 milliamps flows, there will be a voltage drop of 72 volts across it. The effective plate voltage is therefore 800 minus 72 or 728 volts, as the drop across the cathode resistor is of opposite polarity.

Input power is therefore 728 multiplied by .16 or 116.48 watts.

(ii) The grid bias developed across the cathode bias resistor has already been calculated, as it is a product of the total current in amperes. 18 and the number of ohms resistance in the cathode circuit. 400. This equals 72 volts.

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Black enamellised and calibrated front panels for any of above 19/6. 12½% tax, plus postage 1/4.
Instrument Cases, R. and H. Type, finished in grey hammer baked enamel.
MC5A, 9 x 67/8 x 5½, 21/-, plus 12½% tax, plus postage.
MC82A, 13 x 8 x 6, 7/8. 38/6, plus 12½% tax, plus postage.
SF7A, Sloping Front, 7½ x 7½ x 7¼, 21/-, plus 12%, plus tax, plus postage

Standard Instrument Cases. Finish Grey.

Cat. No	Long.	High.	Deep.	Price plus 12% S.T
MC6	6	6	6	13 0
MC7	10	8	7	1 1 0
MC67	12	7	6	1 2 6
MC81	10	10	8	1 7 6
MC811	12	11	8	1 10 0
MC79	15	9	7	1 15 0
SLOPING FRONT CASES				
SF7	7¼	6½	6	1 1 0
SF79	9¼	6½	7¼	1 5 0
SF71	11	6½	7¼	1 10 0
SF8	13	8	8½	1 11 6
SF10	18	10	10	2 6 0
SF79A	9¼	7¼	7¼	1 5 0
SF71A	11	7¼	7¼	1 10 0
SF8A	13	8¾	8¾	1 11 6
SF10A	18	10	10	2 6 0

Chassis unpunched can be supplied for any of above.

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An entirely new type of 4-speed mechanism designed to give absolutely uniform turntable speed with reproduction, free from rumble and frequency modulation.

Motor is AC mains 200–250 or 100–125 volt operated.

Automatic Stop and Start is independent of record size or length of playing surface.

Turntable is of heavy steel with rubber record mat.

Unit plate is the mount of all components with the exception of pick up rest.

3-point spring suspension and check springs eliminate acoustic feed back.

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Features include:

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6050

COLLARO

CONQUEST HI-FIDELITY RECORD CHANGER

NOW AVAILABLE IN STEREOPHONIC!

Check these COLLARO CONQUEST features . . .

• AUTOMATIC PICK-UP POSITIONING

This completely new mechanism gives entirely automatic pick-up positioning on any size of record. There is no finger to be reset and no protruding parts to cause damage to the records.

• AUTOMATIC PLAYING OF ANY SIZE RECORD

The new patented cam design of the "Conquest" allows for the automatic playing of *any* size of record from 6" dia. to 12" dia. and at speeds of 33⅓, 45 and 78 R.P.M. It will also play the new 16⅔ R.P.M. "Talking Book" records.

• CONSTANT SPEED CHANGE CYCLE ON ALL RECORDS

The change mechanism is driven direct from the motor, giving a constant speed change cycle, irrespective of the type of record being played. The drive to the turntable is thus not involved in driving this mechanism and is not therefore subjected to the comparatively heavy loads imposed during the change cycle. In consequence the accurate driving surfaces of the pulleys are preserved without wear or damage.

• SPRING MOUNTED

The spring mounting of the Record Changer Unit Plate has been designed to ensure that the unit remains level, whatever the number or weight of records being played. Two holes are provided for screws to hold the unit for safe transit. These screws should be removed before the changer is used.

• FREEDOM FROM STALLING

The simplicity of this machine and the patented cam design are both responsible for the elimination of all heavy frictional loads and safely permit the use of a low wattage motor which is comparable with transcription practice.

• MANUAL PLAY

A single record may be played by using the manual control, the pick-up being placed on the record in any desired position. After playing a record in this manner the machine automatically returns the pick-up to its rest and switches off.

• RELIABILITY

This record changer requires a minimum of service, and adjustment should not be necessary. It is recommended that if adjustments are required, due to mishandling or accidental damage, the record changer be returned to your usual retailer or direct to the manufacturer.

• COLOURS

The changer is supplied in any of four colour schemes: All cream finish with maroon turntable mat *OR* all maroon finish with gold unit plate and turntable rim *OR* all maroon finish with cream unit plate and turntable rim *OR* all brown finish with mushroom unit plate and turntable rim. This changer is supplied complete with disc type operating instruction card firmly attached to the spindle.

SOLE AUSTRALIAN AGENTS :

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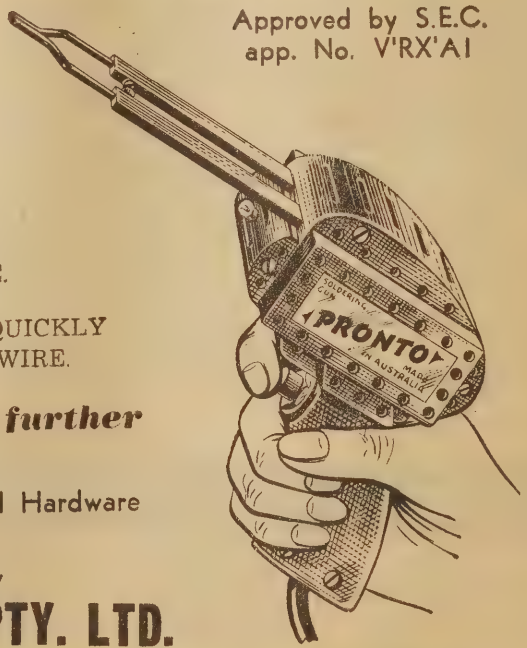

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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

RECEPTION ON SHORT WAVES WITH TRANSISTORS

A number of readers have observed that, when an outside aerial is connected to receivers like the "Transporta Six," short-wave signals are occasionally heard. One reader from Rockhampton set out to investigate and exploit the effect and his letter forms the major part of this article.

TYPICAL of other readers who have received short-wave stations at good strength is a correspondent, W. M., of Henry Head, N.S.W. He says that addition of a primary winding and an external aerial and earth materially boosted the strength of stations on the broadcast band but he was also intrigued to hear a number of short-wave stations from America and Europe.

The reader who investigated this effect further is Mr O. Andersen, who has contributed previously to this page. Certain points in his letter are open to debate but his remarks are interesting, nevertheless.

NOT ENOUGH SAMPLES

For example, it would be unsafe to draw definite conclusions regarding the relative merits of transistor types, based on only one or two samples of each. The characteristics are open to considerable variation, so that the practicability of a circuit and the performance to be expected can only be established after it has been checked with many samples —or selected samples—of individual transistor types.

Now to quote from Mr Andersen's letter:

"During early experiments with a transistor superhet circuit, before factory designed coils were available, it was found that short-wave stations came through at good strength when an aerial was connected to the base of the converter transistor.

"It was reasoned that the small number of turns needed for the input from the aerial and oscillator coils formed a separate superhet circuit and was tunable by the reflected affect of the tuning on the broadcast circuit.

"The reception demonstrated that certain transistors would amplify HF signals, consequently the aerial and oscillator coils were designed for short-wave reception. The results were amazing and practically any station tunable on a valve set on the 31 metre band could be heard at good volume.

"The transistor 2N252 and 2N308 both work well as converters on this frequency. The 2N308 is rated by the manufacturers as an IF amplifier, but, in practice, it was superior to the 2N252. It also gives increased sensitivity as a converter on the broadcast band.

"The circuit used was similar to that recommended by the makers and on the lines of the circuit of the "Transporta Six" of R. TV and H.

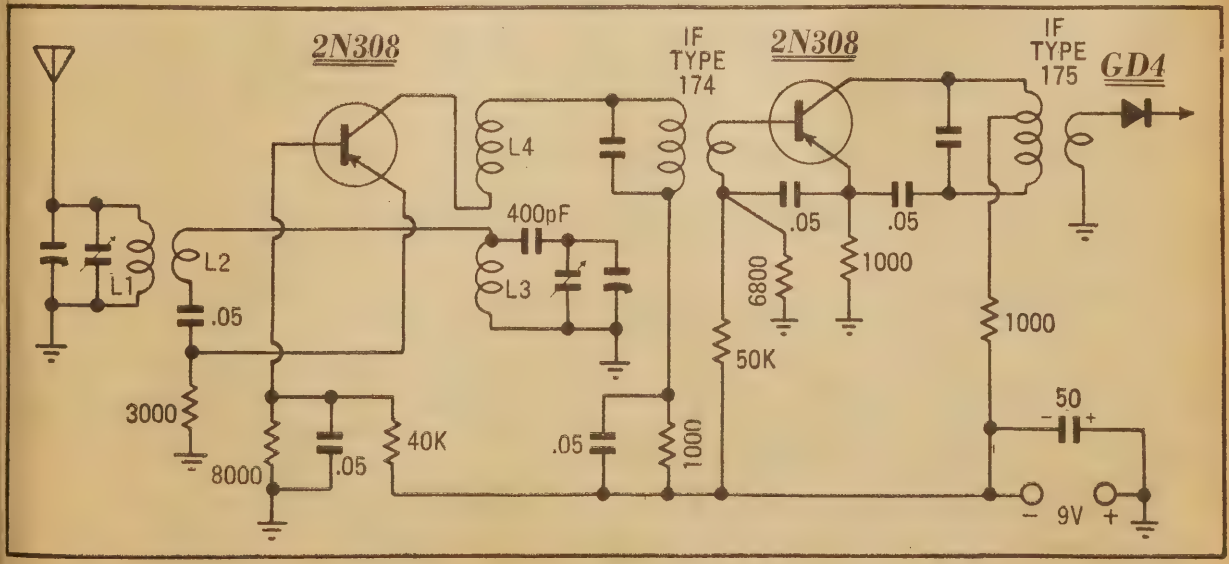
"It was considered that if the input and oscillator signals can both be fed to the emitter of the converter, that transistor would then have the features of grounded base circuitry and the full frequency range of which the transistor is capable would be available. The circuit herewith was designed and built and it was found that, with this circuit the OC44, which failed to operate in the other circuit, also gave good results on the 31 metre band.

SHORT-WAVE TUNER

"A dual-wave set was simple to devise. The short-wave tuner was used with the broadcast set, similar to the "Transporta Six," and a single two-way switch effected change over from broadcast to short-wave. The current drain of either tuner is so low that there is no need to switch off the battery from the tuner not in use.

"It was found that a small piece of Laminex made an ideal chassis for the tuner."

In conclusion, Mr Andersen requests that any reader wishing to correspond with him about the circuit enclose a stamped addressed envelope for reply. His address is O. Andersen, Box 257, Rockhampton, Qld.



Coils are slug-tuned and wound on ¾-inch formers. L1 has 8 turns, L2 6 turns, L3 8 turns and L4 24 turns.

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WHY MAKE CRYSTAL PICK-UPS?

This information which was sent to us from Cosmocord, makers of Acos crystal pick-ups, contains so much interesting information that we thought you would like to read it. Most of the comments apply equally to pick-ups of a similar type made by others.

WE were having drinks the other day with a good friend of ours —at least, not so much of a good friend as someone of considerable importance— and we like to keep on the good side of him. He remarked: "I heard your crystal pick-up was quite good, but it is such a pity that you waste your time on messing about with such an unreliable object; you only have to increase the temperature a bit, and then all the bass goes, and in any case you just cannot rely on them!"

WHAT IS BEHIND IT?

There is an old saying, "There is no smoke without fire," so let us see exactly what kind of fire produced this smoke. Make no mistake, a good many knowledgeable people may have similar ideas. What is true is that the capacitance of a crystal varies according to the temperature. At low temperatures, say from zero to 10 deg. C. (50 deg. F.), the capacitance is low. At about 22-30 deg. C. (72-86 deg. F.) it rises appreciably, and above 30 deg. C. (86 deg. F.) falls again.

The only thing that you hear that is altered by change of capacitance is bass. If this were all then it would be quite true to say that crystal pick-ups were unsatisfactory, because when temperatures rise over 30 deg. C. (86 deg. F.) (admittedly uncomfortably hot for an ordinary room), then the bass would fall badly. But the effect of the value of the input resistance is overlooked.

In the coupling between one stage and another it is the relative values of the condenser and grid-cathode resistance that affects the bass. You may remember that if the resistance is lowered beyond a certain value, the bass is reduced. Similarly if the resistance is kept constant and the capacitance reduced, the same thing happens. Exactly the same state of affairs exists when a crystal pick-up is fed into an amplifier.

BASS DIMINISHES

Should the value of the input resistance be just enough to give reasonable bass response when the temperature is at 20 deg. C. (68 deg. F.), then at 40 deg. C. (104 deg. F.) the bass will have dropped off to such an extent that the reproduction will sound a bit thin. An input resistance value of 500 K.ohms will produce this state of affairs. If the input resistance is increased to something like 2 M.ohms, however low the capacitance of the crystal may fall, there will be no noticeable lack of bass. This is the main reason why we always recommend an input load of 2 M.ohms on all our literature.

Once more we have an illustration of "A Little Learning Is a Dangerous Thing." So firmly is this misconception held that an untruth is in real danger of being accepted as a truth

(Editor's note: The above remark might itself be open to argument on the grounds that the "cure" also has its limitations Though a high value of load may prevent loss of bass under the worst conditions, it may equally lead to some unnatural boost in the 200-cycle region at normal room temperature. At least, this is our impression from some of the older pick-ups.)

We have, in fact, seen several articles in technical and semi-technical publications, saying quite correctly that capacitance changes when temperature changes. This has been pointed out as a disadvantage of crystal transducers, without any of the aforegoing explanations being given.

We will admit that we have been at fault in not having had any suitable answers printed in like journals. It is in these bulletins that we are taking the first steps to rectify and make good our omissions.

ANOTHER CRITICISM

Whilst we are on the subject, there is another criticism levelled against crystals —their life is unpredictable. We have heard it said, "They are all right when they are new, but wait a couple of months and they will go down." By this it is meant that the output is greatly reduced and the frequency range restricted at both ends of the spectrum. A rochelle crystal, if left "naked" and subjected to moisture, will tend to dissolve in its own water of crystallisation, and the result would be low or no output. Under ordinary living-room conditions, there would not be enough moisture to cause this to happen, but there would be in a damp basement.

To overcome this disadvantage, we coat the crystal three times with moisture-proof material. There is nothing special about this; all crystal manufacturers adopt similar courses. The actual method by which sealing against moisture is achieved, varies from manufacturer to manufacturer. The sealing must be effective and the process economical. At this stage of the art, we are successful as far as United Kingdom conditions are concerned. Unexpectedly enough, in such places as Singapore, experience shows that we have about an 80 per cent chance of success.

STEREO ONCE MORE

We have now had stereo in our own home for three months, and feel we are in a position to say something about its effect upon us. With single channel "hi-fi," good as it was, we always had a feeling on our return from a concert or opera that it was all a bit unreal. Mainly in separation of the instruments of the orchestra, and even the separation of a singer from a piano accompaniment. We might say that we go to a concert or recital about every ten days, and opera, say, about once a month.

With stereo there is something infinitely more satisfying. Individual instruments stand out, voices take on a more realistic colour; in other words, Kirsten Flagstad sounds more LIKE the Kirsten Flagstad we remember. The Philharmonia Orchestra has, on disc, much more of the bloom it has in the concert hall.

NOT FOR BACKGROUND

One thing, too, you must listen. Stereo is no good as background music. With single channel reproduction, there is always a certain amount of fatigue after a period of listening. With stereo there is not. Stereo is not a gimmick, it is an advance in the science of reproducing sound.

Occasionally we have had some bewildering reports on the performance of stereophonic cartridges. Having sent two as near identical cartridges as makes no difference out to two different customers, we had one report giving separation at 10dB and the other at 25dB, with like variations on the frequency response. Now both of these cartridges had been tested in the laboratory and both of them gave a separation of 20dB or slightly more. The moral of this story is that separation figures depend to a very large extent on rumble from the motor and noise from the test record, which will mask the wanted signal and give apparently poor separation and response. Therefore, if presented with a test report which indicates poor performance, try and find out the conditions under which the tests were conducted.

MOTOR, TURNTABLE

Things to look for are a rumble-free motor, firmly fixed to a solid base board; clean and static-free test record; a carrier arm that is perfectly free both laterally and vertically. Remember, too, that the turntable must be perfectly level and also the base of the pick-up must be parallel in relation to the disc. If this is not so, then the stylus will press harder against one wall of the groove. This will give a stronger signal from this particular channel, which will then again affect separation figures adversely. We have run into these pitfalls ourselves and even condemned a whole batch of stereo cartridges only later to discover that they were perfectly all right, but somebody had inadvertently put the turntable out of level.

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- ★ HIGH VOLTAGE PROBES By Palec, University, A.W.A., Avo, Taylor, Hansen, Metrix.
- ★ INSULATION TESTERS By Gossen, Taylor.
- ★ LIGHT METERS By Gossen.
- ★ LO CAPACITY PROBES By J.M., A.W.A.
- ★ MULTIMETERS See our Advertisement on Page 74
- ★ OSCILLATORS By Advance, Avo, A.W.A., Palec, Taylor, Klein & Hummel, Hartmann & Braun Cossor, University.
- ★ PROBES By A.W.A., Avo, Taylor, Palec, University, Metrix.
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NEW BOOKS

"INTERNATIONAL RADIO TUBE ENCYCLOPAEDIA," 3rd Edition, 1958-59, by Bernard B. Babini. Published in London by Bernards (Publishers) Ltd., approximately 700 pages. Australian retail price as quoted, 82/-, plus 3/6 postage.

There are occasions in the life of every engineer, technician and radio enthusiast, when work is held up because a particular valve (or tube) cannot be identified or its characteristics ascertained. There follows a frantic search through a varied assortment of books and pamphlets, which may or may not be rewarded.

TUBE ENCYCLOPEDIA

This difficulty can largely be overcome for the expenditure of 82-/, which is the purchase price of the latest International Radio Tube Encyclopaedia. According to the publisher's comments, it now gives data on more than 27,500 different valve types, 9,000 of which have been added to the range since 1949, when the first edition was printed.

The lists include tube types from England, America, Australia, Japan, the U.S.S.R. and European countries, both intended for domestic and commercial equipment and those made for the armed services.

For example, all CV, VR, VT classifications are shown, with characteristics and commercial equivalents.

Sections include receiving tubes, transmitting tubes, rectifiers, thyratrons, regulator and control tubes, tuning indicators, cathode-ray tubes, phototubes and "rare" types.

The data on each type includes nominal filament and electrode voltages, mu, Rp, Gm, power output, base connections, maker and a cross-reference to the service equivalent or commercial equivalent, as the case might be, and where applicable.

SPECIAL TYPES

Data is given also on such tubes as klystrons, magnetrons, velocity modulators, cavity tubes, counter tubes and other such unusual types.

To realise the full value of the book, it would be necessary to spend some time studying the various sections, due partly to the fact that the book is constituted from earlier volumes, plus supplementary sections. For all that, it would appear to be a "must" for radio laboratories and represents good value for the money.

A card on the inside front cover implies that additional supplements will be issued from time to time. (Our copy from the Technical Book and Magazine Co., 295 Swanston St., Melbourne, C1.)

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	Lenco GL.55	30	0	0
	Thorens TD.124	73	15	0
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	Goldring G-60	8	10	0
	Ortofon: Full stocks available, "A," "C" and Stereo heads 12in, 16in and Stereo arms.			
Amplifiers:	Leak TL12 plus	57	6	1
	Leak TL25 plus	76	13	0
	Leak TL50 plus	106	2	0
	Leak Varislope III Pre-amp	48	6	5
	Leak.1 Plus Pre-amp	38	4	5
	R.C.A. Orthophonic	139	10	0
	Quad II Complete	115	5	0
	Verdik c/w 1 v Pre-amp	52	10	0
	Verdik c/w 2 v Pre-amp	59	10	0
Record Players and Changers:				
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BSR UA8 Changer		20	10	0
Dual 295 Player		18	10	0
Dual 1004-T-12 Auto. Player		28	10	0
Dual 1004 Changer		32	8	6
Dual 1005 Changer		37	9	6
Thorens CB33N Player		35	15	0
Thorens CBA83N Auto. Player		44	17	6
Thorens CD43N Auto. Changer		59	10	0
Collaro 4T-200 Transcription		31	2	6
LOUDSPEAKERS:				
Wharfedale:	W15/FS	44	3	7
	Super 12FS/AL	44	3	7
	W.12/FS	28	1	9
	W.10/FSB	25	5	6
	Golden 10in	17	2	9
	10in Bronze	11	0	0
	Column 8/145	15	10	6
	Super 8FS/AL	13	12	4
	Super 8FS	13	0	3
	Super 3 Tweeter	13	12	4
Goodmans:	Axiom 300	29	1	9
	Audiom 60	25	17	8
	Midax	21	18	3
Grampian:	1255/15	20	6	3
Rola:	12UX Hi-Fi	28	19	5
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Goodmans:	Trebax	12	5	3
Ibbott:	360 deg	14	14	0
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	LSH.518	1	2	6
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Here's your answer, Tom!

To judge by his letter, Tom is rather bewildered by the array of audio equipment which is currently offered for sale. In particular he is interested in pickups and wants to know the basic difference between magnetic and other types.

What is the difference between magnetic, moving coil, crystal and ceramic pickups and which gives the best quality sound?

Pickups may be classified into two general groups, those that use the electro-magnetic principle for the generation of electrical impulses from the record and those that use the piezo-electric principle.

In the first group we have moving coil types, variable reluctance types and ribbon types. All these are termed magnetic and all use the principle of a relative movement between a magnetic field and a conductor to generate a voltage.

In the moving coil type of pickup, the stylus is attached to a tiny coil or a metal ribbon, supported flexibly in a magnetic field provided by a small permanent magnet. As the stylus follows the deviations in the recorded track, it moves the coil or ribbon relative to the magnetic lines of force, so generating current and voltage in the coil or ribbon, equivalent to the degree and frequency of movement.

In most other types of magnetic pick-up, the coil is fixed relative to the magnet. However, the stylus moves a small metal vane or ribbon in the magnetic field, disturbing the lines of force. Thus we have the reverse situation of a fixed coil cut by moving lines of force but, once again, voltage and current are generated in the coil.

This constitutes the output signal, which is ultimately fed to the first grid of the associated amplifier.

PIEZO-ELECTRIC TYPES

In the second group we have pickups of the crystal or ceramic type. Both use the piezo-electric principle, which is a property of certain substances to produce electric impulses when under mechanical stress.

The stylus is attached to one corner of a slab of crystal or ceramic, which is otherwise anchored inside the pickup head casing. Movements of the stylus riding in a record groove provide the stress on the crystal, which then generates the appropriate voltages.

Magnetic pickups, among which moving coil types are the finest example, are commonly credited with the best ultimate performance. Due to their careful mechanical construction they are capable of very linear response over a wide frequency range. This fact, coupled with their natural frequency law, allow very accurate compensation to be made for the recording characteristic.

Against this, magnetic pickups usually have a very low output, are not very robust and are comparatively costly. Their use is therefore largely restricted to the higher-priced, "specialist" market.

Compared to the magnetics, piezo-electric pickups (i.e. crystal and ceramic) usually exhibit a somewhat narrower frequency range, with more noticeable resonance effects within the range.

Their basic output/frequency law is different also and these two facts, considered together, make it difficult and often not worthwhile to achieve really accurate compensation for the original recording characteristic. They are therefore likely to appeal less to the highly-priced specialist market.

On the other hand, their natural output is comparatively high and approximates the correct frequency law when fed into the specified value of load resistor. This makes them very easy to use with more simple types of amplifier and the final result is judged as satisfactory by most people.

The most commonly used crystal for the manufacture of piezo-electric pickups is Rochelle Salt. This substance is readily affected by temperature and humidity and necessitates careful construction and sealing of the cartridge. Even so, crystals are still susceptible to damage in unsuitable climates.

Of recent years cartridges have been produced using barium titanate in the form of a ceramic. It is comparatively free from temperature and humidity effects and has a performance comparable to the crystal pickup, except for somewhat lower output. Its method of construction is also similar.

Summarising, Tom, both groups have advantages and disadvantages. Their choice, however, will be governed to a large extent by the standard and cost of the associate equipment. For a listener requiring the ultimate, a magnetic pickup is almost "a must."

But all this need not discredit crystal pickups, for the best of these are very good indeed.

"Our latest model — in case of a power failure" — TV Times

★ ★ ★

A car ignition coil turns six volts into several thousands of volts, and yet this has apparently less power than the original six. Why is that so?

It is a matter of internal resistance. If you were to connect a meter across the secondary of the ignition coil you would discover a resistance of many thousands of ohms, made up by the enormous number of turns on the winding. A direct short circuit across this coil would result in a very small current, due to this figure of internal resistance.

Another point is that the voltage and current in the secondary is alternating, so that it has a character quite different from the original six volts DC.

But to operate a car ignition system you must have a nice fat spark and to produce this you need volts—plenty of them.

So it doesn't really mean much to say that the secondary voltage has less power than the original six. In actual fact, it does something which the lower voltage could not do—it produces a spark across the plug points.

★ ★ ★

Should one use a small speaker with a small set? It seems to me that a large speaker would be harder to drive?

We can't blame you for asking this one, Tom, it is easy to get the wrong impression, for it certainly looks that way at a first glance.

But here's the point: Big speakers generally have bigger and heavier magnets and a stronger magnetic field around the voice coil. Their cones may be somewhat heavier and harder to move but the difference isn't enough to offset the advantage of the big magnet. Consequently, when a certain amount of power is fed to the larger speaker, there is every chance that it will make more noise than the small one.

If you have any doubts on this score, Tom, try feeding a portable into a 12-inch speaker instead of its own 3-inch one. You'll be amazed at the difference.

Of course you can't have 12-inch speakers on portable sets, that is unless you are prepared to carry around a suitcase. As a compromise, some of the larger portables such as our "Senior Portable" used a 7 or 8 inch speaker for maximum efficiency. These are nearly as good as some 12-inch speakers.

better than a 5-inch one and considerably better than a little 3-inch one.

So there we are, Tom, given speakers of equally modern design, it is always the best plan to use the largest one you can conveniently house in the cabinet. Far from being harder to drive they are generally a good deal more sensitive.

But don't forget, Tom, that speakers vary in sensitivity from one model to another. If you have any worry about getting enough sound, always use the most sensitive speaker you can buy, in the size you want. Manufacturers' data will help you in choosing the right one.

★ ★ ★

Can you tell me why I get overseas stations among the broadcast stations when I connect the aerial to the top cap of the converter in my set?

The overseas stations which you receive when you place the aerial on the converter grid could be broadcast stations. Due to your isolated location these might well be heard with strength almost equal to some of the Australian stations.

When the aerial is connected as you describe, it could feed very strong signals into the set, particularly if it is long and high. As you are located rather remotely from strong Australian stations, you could hear signals from elsewhere which others would find drowned out by their closer proximity to the locals.

★ ★ ★

When using a tube with similar plate and screen currents as an IF amplifier, is the primary of the IF transformer connected across the plate and screen and is the supply voltage derived through a common dropping resistor from the B supply? Will the total current through the resistor be the sum of the plate and screen currents?

In answering this query we shall commence at the end. If a common dropping resistor were used for both the plate and the screen supplies, then the current flowing through it will be the sum of the individual currents.

Some battery valves must have their screens operating at a lower voltage than the plates and a screen dropping resistor is used. The plate is connected directly to the HT line through the primary winding of the IF transformer. You could say, therefore, that the IF primary is connected between the plate and screen, although this way of looking at the circuit doesn't give a very accurate mental picture of what is actually going on.

★ ★ ★

In a battery set is the grid bias on the output stage most suitably obtained by the use of a resistor capacitor combination in the cathode circuit or by connecting several cells across the cathode and grid in such a way as to make the grid negative?

In a battery receiver the bias for the output stage is generally obtained by the use of back bias. A resistor is placed in the negative return lead so that the HT current drain flows through this resistor. The voltage drop thus obtained is applied to the output valve grid by returning the grid leak to the resistor instead of the chassis.

Separate C batteries have been used for biasing but the difficulty of discharging them at a rate comparable to the rest of the batteries used has led to the popularity of back biasing where the bias voltage automatically adjusts itself throughout the B battery life.

★ ★ ★

Is the placing of the volume control after AVC necessary? Also is the volume control any more effective in the first AF stage than in the output stage?

The placing of the volume control after AVC is necessary for, although, the AVC has a controlling effect on comparative signal levels, it is unable to set the overall audio level to suit individual requirements.

The volume control may be the diode load, or placed in the grid circuit of the following valve. Using it as the diode load has a number of advantages. It allows us, for instance, to make use of the contact potential of the first audio valve to obtain bias by using a high value of grid leak, and this eliminates several components which would otherwise be necessary.

The volume control is best located in the early part of the audio section to prevent overloading of the first grid, as would probably happen if the volume control were placed in the grid of the output stage.

★ ★ ★

Some valves have "sharp cut-off characteristics," according to valve-data books, while others have "remote cut-off characteristics." How do you decide which type to use?

It isn't very difficult to give you the origin of the terms, Tom. In the case of a "sharp cut-off" valve if, after the valve has been set up for normal operating conditions, the grid bias is increased to greater than normal, the plate current of the valve will decrease proportionately. Eventually a point will be reached where the plate current will cut off quite abruptly.

If you impose the same conditions on a "remote cut-off" valve you will find that as the negative grid bias is increased step by step, the decreases in plate current become progressively smaller, with the result that a very much greater bias is required to make it stop altogether than in the case of the "sharp cut-off" type.

That explains the terms, but we still haven't come to the most important point. As the negative bias of the remote cut-off valve is increased, its tranconductance also becomes gradually less and, if you apply sufficiently high bias, the valve will cease to amplify at all.

This very useful characteristic is achieved by a special construction of the grid of the valve.

Instead of winding a perfectly even spiral, some of the turns at the centre are spaced further apart than the rest.

A moderate negative bias prevents electrons flowing through the ends of the grid, but very much more is required to prevent current from flowing through the centre of the grid.

If you use a valve having remote cut-off (or variable-mu) characteristics in one of the high-frequency amplifying stages of a receiver, the negative voltage from the AVC circuit may be applied to its grid. As the strength of the carrier wave varies, so will the gain of the valve vary, tending to keep the volume the same.

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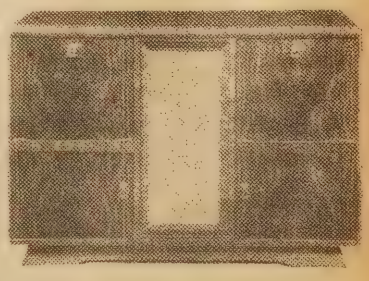

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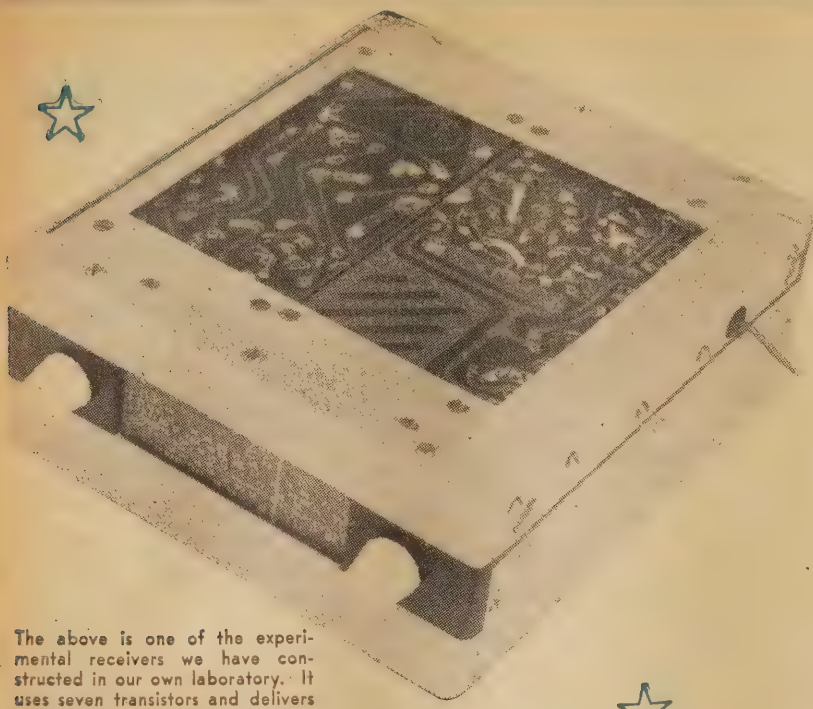


A removable top cover allows access to the printed wiring boards should component replacement be necessary. Transistors, transformers and other small components are supported below the wiring boards and can be checked by removing a second cover.

The above is one of the experimental receivers we have constructed in our own laboratory. It uses seven transistors and delivers almost a watt of audio power. With overall dimensions at 7½in by 6½in by 2¾in there is space to spare.

Designing A Modern Car Radio Receiver

Significant changes in the design of car radio receivers are at present taking place. Prompted by the availability of special valves, designed to operate with car accumulator voltages applied to plates and screens, plus transistors, manufacturers are turning out extremely compact and reliable receivers with current drain figures very much less than that of vibrator receivers. This article reviews current design trends in relation to homebuilders.

by Maurice Findlay

PROSPECTIVE car radio buyers in this country at the present time are offered two types of receivers. The first may use 4, 5 or 6 valves plus a vibrator power supply and is the type which has been standard with large manufacturers for many years.

In the last few months, several manufacturers have offered receivers using one or two transistors plus three or four valves. Advertisements for these receivers usually manage to include the word transistor in such a way that the ordinary buyer would be justified in assuming that the radio is fully transistorised. In the trade these receivers are known as "hybrid" types and the special valves they use are known as "hybrid" valves.

For a better understanding of the position, we would do well to consider the characteristics of valves in general and at the same time take in a few significant facts about transistors.

Series of valves designed to operate with an accumulator/battery combination were made available early in the history of receiver design. For example, two-volt filaments could be strung in a series and/or parallel combination to operate from an accumulator while a series connection of dry cells making up between 100 and 150 volts constituted a suitable supply for the plates and screens of the valves.

We recall early descriptions of car receivers using these valves. Filament power was often obtained from the car's main battery while a set of dry batteries was installed especially for the high-tension supply.

Although a well-designed receiver along these lines could be made to have an excellent all-round performance there were serious disadvantages. Valve life was short because the filaments were designed to operate from the normal voltage of the accumulator. Depending on the charging system, this could rise appreciably with the vehicle in motion. Valve failure due to vibration was also a problem. Roads and the cars themselves were not as smooth as they are now and valve manufacturers had a good deal to learn about making rugged valves.

NOT ECONOMICAL

The need for frequent replacement of an expensive set of dry batteries added to the problems, making music-while-you-drive a reservation for the rich and the keen experimenters.

Indirectly heated valves, inherently more rugged both mechanically and electrically plus the availability of DC converters to operate from the 6 or 12-volt car supply and deliver from 100 to 300 volts, made car receivers a practical proposition for the ordinary motorist.

For the most part, the electrical circuitry of car receivers followed the same trends as that of domestic receivers operating from the AC supply mains except that, if anything, the performance had to be a little better because of the long distances which often separated the listener from the station, and the necessarily inefficient aerial.

Interference from the car's ignition system was, and is, a serious problem, making it necessary to adopt special shielding precautions. It is standard procedure to shield every item in a car receiver except the aerial.

Radio frequency interference from the DC converter is also a problem and special precautions are necessary to prevent this being coupled into the amplifying section of the receiver.

Two types of DC converters have been used. The first is essentially a low voltage electric motor driving a high-voltage DC generator. Mechanical simplification is possible by using a common field supply and a common armature. The

only feature to distinguish a genemotor from a simple motor to the casual observer is a second commutator.

The sizes used in car receivers run at an efficiency of about 60 per cent. They are very reliable, have a long life and require relatively simple shielding and filtering to eliminate interference. Mechanical vibration is a problem but the main reason that they have not been used more extensively in ordinary car receivers is their high cost.

Cheaper DC converters can be made by using a vibrator to interrupt and alternately reverse the direction of the DC primary supply. The waveform delivered by the vibrator is suitable for application to the primary winding of a transformer where it can be stepped up to almost any desired voltage. A valve rectifier and filter may be used to produce a smooth DC supply or the valve may be omitted by employing a set of synchronised contacts on the vibrator to switch the high-voltage output of the transformer.

SIMILAR EFFICIENCY

Efficiency of the vibrator supply is about the same as the genemotor but the life and inherent reliability of the vibrator itself are not as good. Very careful design is necessary to completely eliminate interference in highly sensitive receivers due to sparking at the contacts of the vibrator. Commercial designers have succeeded in solving the interference problem and vibrator life is good enough for most purposes. The vibrator high-tension supply has, up-to-date, almost universally been used for car receivers and power supplies for small mobile equipments.

Complete elimination of vibrator interference is often a difficult and lengthy business and a home builder may spend almost as long securing satisfactory performance in this respect as in building the rest of the receiver. In a factory, where the exact placement of every wire and component is under control there is no great problem once the design has been finalised.

An entirely new approach to the design of car receivers has been made possible by the invention of the transistor. Its development into a highly reliable and efficient device over the last 10 years will have a big influence on many things including car receivers.

LOW VOLTAGE DEVICE

The reason is that the transistor operates efficiently and can produce high power outputs when operated directly from the car battery supply of 6 or 12 volts.

If a car radio could be fully transistorised, all the problems and expense of the vibrator or genemotor supply could be completely eliminated. No power would be wasted due to the poor efficiency of the supply and filament power would no longer be required.

Against a current drain of about 2½ amps from a 12-volt supply for a vibrator receiver, an all-transistor receiver could be designed to draw only ½ amp if using a class A output stage. Class B operation of the output stage would reduce the average total current drain to half this value or less on the average.

Supplies of transistors have increased greatly even in the last few months and there is no reason why, if he specially wished, any commercial manufacturer could not turn out a fully transistorised car receiver. The reason he does not do so is that it would cost more.

Seven or eight transistors would be necessary for a high performance car receiver as against 5 or 6 valves for a receiver of equivalent performance. Each transistor may cost the manufacturer several times the amount for a valve. In order to show a profit, the manufacturer would need to sell the transistor car radio at a very much higher price than its valve equivalent.

The average non-technical person knows that the generating system of a modern car is capable of taking care of the load of an ordinary vibrator radio without difficulty and he is not likely to pay more for a radio just for the satisfaction of knowing that it takes less current or that it is likely to be a little more reliable. Car radio manufacturers are in business to sell car radios. Hence none of them makes a fully transistorised receiver.

CHEAPER TRANSISTORS

However, the present is only a temporary situation. Transistor manufacturing techniques are improving and when fully developed there is every reason to expect that the cost of transistors will actually be less than that of valves, making possible not only a cheaper but a more economical car receiver.

Just when the fully transistorised receiver will be able to complete economically with the valve plus vibrator version is difficult to predict. Estimates we have heard from engineers closely associated with the matter have varied from one year to two years but it is certain that it is not too far away.

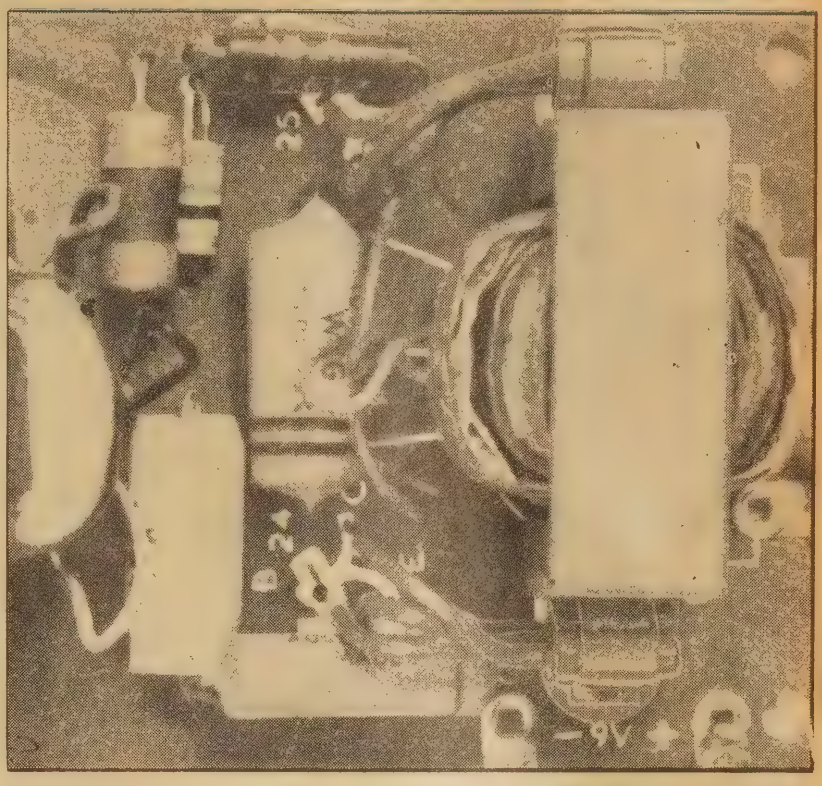
In the meantime it has been possible to gain most of the advantages of a fuly transistorised receiver at a cost about the same as that of a vibrator-valve set by employing three or four of the hybrid valves, plus a couple of transistors. The transistors are used in the output stage or stages and supply the audio power necessary to drive the speaker. The valves are employed in the earlier stages of the receiver where the signal level is low and amplification rather than power output is the important factor.

6V AND 12V "HT"

Hybrid valves operate with the car battery supply applied directly to their plate and screen circuits, i.e., with 6 or 12 volts "high tension." They are manufactured by the same general techniques as ordinary valves, but special design features enable them to perform well at voltages which, for a valve, must be considered extremely low.

Mutual conductance (gm) is one of the most important factors governing the amplification available from an RF amplifier valve and for a typical valve from one of the hybrid series operating from a 12 volt supply, the figure is about 1.8 mA/V. This is of the same order as some of the earlier RF pentodes using 250 volt high tension such as the 6U7-G.

MOUNTING THE POWER TRANSISTORS



Details of the audio wiring board for the experimental receiver shown opposite. The output transistors are mounted in metal clips or "heat sinks" which increase the amount of power the transistors can safely dissipate and hence the audio power available.

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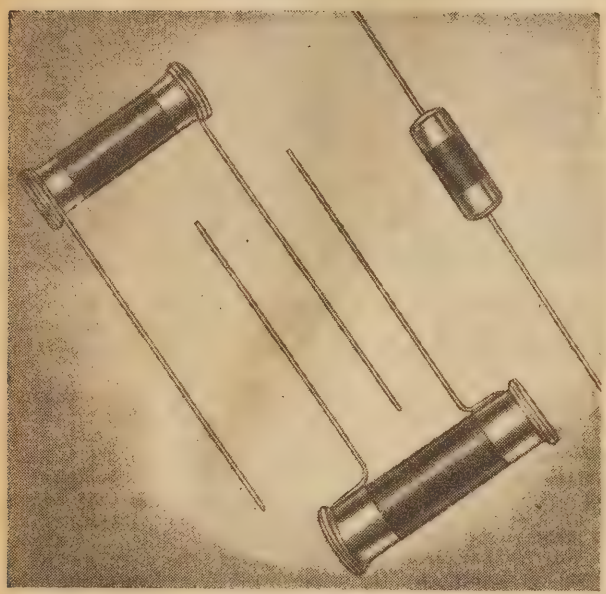
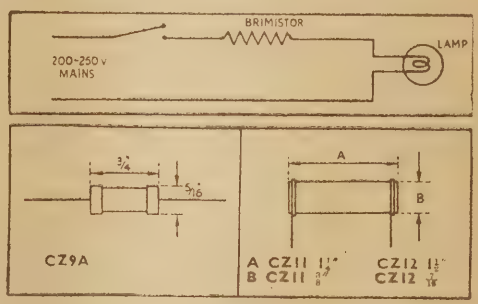


TYPES AND RATINGS

Brimistor Type.	Maximum Continuous Running Current.	*Lamp Wattage.	Resistance at 20° C.	Resistance at Maximum Current	Retail Price.
CZ9A	1.0A	150 W.	350	3.7	2/11
CZ11	1.5	250 W. or 300 W.	140	2.5	5/3
CZ12	2.5	500 W.	120	1.5	6/8

* These figures apply to lamps operated on the 200 to 250 volts supp however, Brimistors may be used at lower voltages if the maximum c tionuous current is not exceeded For example, the CZ11 could be u with a 110-volt 150-watt lamp.

EASILY FITTED TO ANY TYPE OF PROJECTO



GENERAL INFORMATION

The resistance of a projector lamp filament increases many times with temperature. Thus at the instant of switching on, when its filament is cold, its resistance is low and a very high surge current will flow for a fraction of a second. To avoid this undesirable surge, a Brimistor should be fitted in series with the projector lamp. Brimistors have a large negative temperature coefficient, so that their resistance falls as they warm up. Thus at switch-on, the current through the projector lamp is limited by the cold Brimistor. As the Brimistor warms up its resistance rapidly falls so that after a short time the full supply voltage is applied to the lamp, giving good suppression with the minimum of delay.

OPERATING NOTES.—At the maximum current rating, the body temp ture of a Brimistor may reach 250 deg. C. Thus care must be taken mounting to avoid damage to adjacent components.

Since Brimistors operate by self-heating, it is important to ensure that are not cooled by the fan when one is fitted to the projector.

At least ½in lead should be left free when connecting into circuit. Bri tors are made of a rather brittle material and will fracture if dropped subjected to severe mechanical shocks: they should, therefore, be han with care.

After switching off, ten minutes must be allowed for the Brimistor to down before switching on again if good surge suppression is required. H ever, if you do switch on again almost at once, you are doing no w than you would without a Brimistor.

Brimistors must not be operated in parallel

K107

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Later miniature RF pentodes have a gm of the order of 4 mA/V, but for reasons of stability it is not always possible to make use of the full gain in each stage.

Manufacturers have issued data on the operation of the hybrid series from a 6 volt supply, but the performance is very much inferior to that on 12 volts, making 6 volt operation a doubtful proposition.

A typical hybrid receiver would employ an RF amplifier, a mixer and oscillator in a single envelope, an IF amplifier and detector in a single envelope, plus an audio amplifier. The last is coupled to the input circuit of a transistor which feeds the speaker. Where a reserve of performance is required a second transistor may be employed.

Although the cost of the high power output transistor is a good deal more than that of a valve, the overall cost of the receiver is about the same because the vibrator, vibrator transformer, and some of the filter components have been eliminated.

Overall current drain is greater than that of a fully transistorised receiver because of the heater power required by the valves, and this, in a typical case, would total 1.1 amps.

BEWARE POLARITY

Polarity of power supply is very important with receivers using transistors since a reverse connection could cause destruction of the transistors within seconds. Wiring differences in the receivers are usually quite appreciable and manufacturers may find it convenient to list two completely separate receivers, one for positive battery ground and the other for negative battery ground.

The mounting method and placement of the transistor is important because the amount of power it can dissipate, and hence the audio power output of the receiver, is governed by the efficiency with which the heat can be conducted away. Standard procedure is to bolt the output transistor to a large metal area forming part of the case.

Our remarks to this point have been of a fairly general nature and it remains to discuss both the hybrid and the all transistor receiver in more detail.

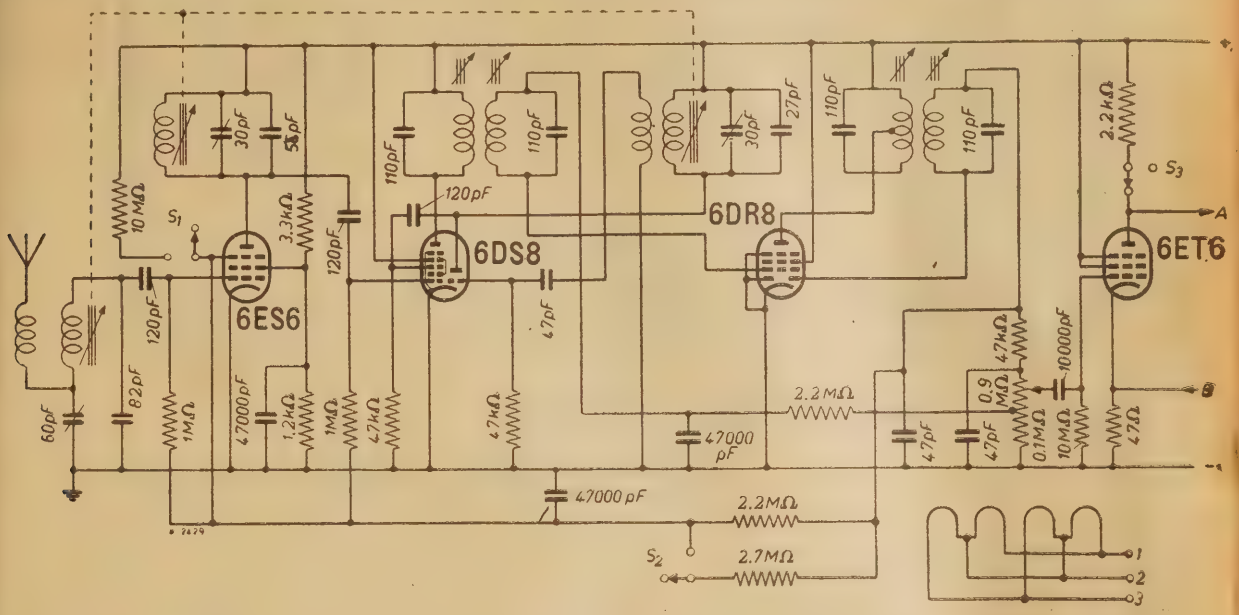
A circuit illustrating the application of their own series of valves has been made available to us by the Miniwatt Electronics Division of Philips Electrical Industries Pty. Ltd. The circuit includes four valves plus a transisitor audio unit which may use one or two transistors.

Except for the permeability tuning unit and perhaps the tapped second IF transformer, all components, including the valves, are readily available to home-builders. If anybody is interested in building a receiver along these lines, it should not be too hard to modify the circuit to substitute a variable capacitor coil combination for the first.

The RF amplifier valve is a 6ES6 variable-mu pentode. The heater is rated at 6.3 volts and 0.3 amperes. With 12.6 volts applied to the plate, 6.3 volts to the screen and the control grid biased to —0.8 volts, the plate current is 2.5 mA and the gm 1.8 mA/V. Under these conditions, the plate resistance is 0.1 megohm, which is a little on the low side.

Plate resistance increases when the screen voltage is decreased and the condition for optimum gain may be one which results in less than the maximum gm. As an illustration of this, the Philips circuit operating from a 6 volt supply results in the very low screen potential of 1.5 volts. The gain is then optimum at about 40 over the entire frequency range.

It is important in a car radio that the automatic gain control system be effective. In the Philips design, the AGC control voltage is applied to both the first and third grids with this object in mind.

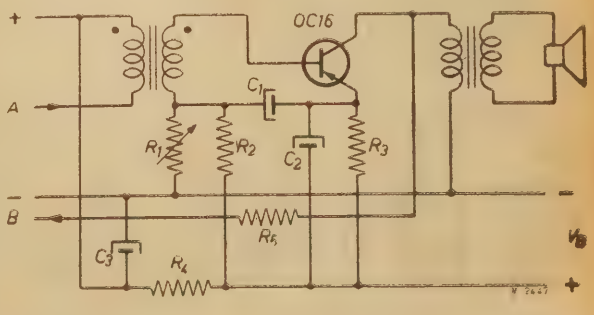


This circuit is suggested by Philips for their range of hybrid valves. It is adaptable to operation from either 6 or 12 volts.

MIXER GAIN

A conversion gain of 12.5 is obtained from 6DS8 mixer valve operated from a 6 volt supply. Coupling from the triode oscillator section to the heptode mixer is by means of a capacitor connected from the plate of the former to the third grid of the latter. Otherwise, the circuit follows conventional practice.

Double diode pentode type 6DR8 is used as an IF amplifier and detector.



This circuit is suitable for use in conjunction with the hybrid valve RF end when the supply is 12 volts. The driver transformer should have a step-down impedance ratio of approx. 4,500 ohms to 20 ohms and the output transformer should match 25 ohms to voice coil. Power output is better than 2 watts. Values are: R1 50 ohms max., R2 6 ohms, R3 3 ohms, R4 5 ohms, R5 2.2 Kohms, C1 1000 uF, C2 1000 uF and C3 500 uF.

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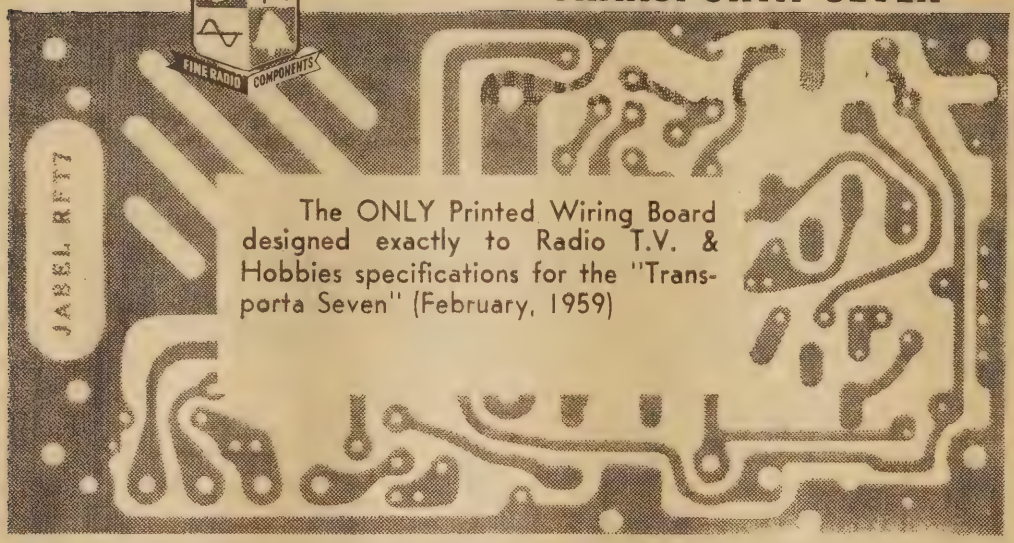

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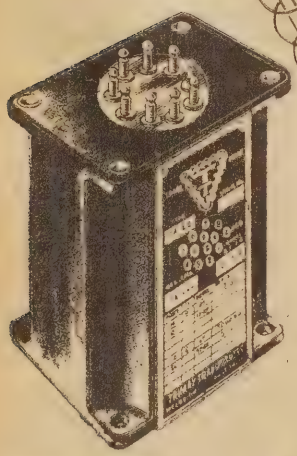

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The main point of note about the circuit is the tapped second IF transformer, which is used in order to obtain the largest possible AGC control voltage.

The valve line-up is completed by a 6ET6 pentode, operated with grids 2 and 3 connected to the 12 volt supply line. The 6ET6 amplifies the output of the detector and supplies the drive power for the transistor audio unit.

Hybrid valves are also made locally by the Amalgamated Wireless Valve Company. The 12BL6 from the AWV series is designed to operate with between 10.0 and 15.9 volts applied to the heater, but for longest life the range 11.0 to 14.0 volts is to be preferred. Current drain at 12.6 volts is 0.15 amps.

The 12BL6 is a remote cut-off pentode with a gm of 1.35 mA/V under typical operating conditions. Its plate resistance is 0.5 meg, and bearing in mind that the dynamic impedance of IF and RF transformers may be of the order of 0.1 meg., the high plate resistance may result in higher gain than the gm figure would suggest. Comparison with other types on a gm basis may not be entirely fair. Construction of the 12BL6 is similar to the 6BA6.

The 12AD6 is a pentagrid type of converter similar to the 6BE6, but as with the 12BL6 there are many important differences. Heater ratings are the same as for the 12BL6. Under typical operating conditions with the oscillator grid current at 50 uA, the conversion conductance is 260 uA/V and the plate resistance 1.0 meg.

6-VOLT PERFORMANCE

Although data for 6-volt operation of the Philips series is given, performance on 12 volts is very much better. This, coupled with the fact that most modern cars use a 12-volt electrical system, will mean that few, if any, hybrid car receivers for 6-volt operation will be made.

With a 12-volt supply, a single transistor audio amplifier along the lines of that published could be contemplated. If the supply were only 6 volts, at least one additional transistor stage would be required.

Some special design considerations are necessary in receivers using transistors in the output stage. Most of these arise from the fact that transistors are sensitive to heat.

Circuit engineers accustomed to valves tend to think of the valve as intrinsically able to dissipate so much power as heat. This is because we generally use valves without any special cooling methods, but in positions where a certain amount of convection is possible.

Transistor dissipation ratings are approached from a different point of view. The limiting factor is the temperature of the germanium. Applied voltage has to be watched carefully, but heat dissipation limits are almost invariably reached before current ratings are exceeded.

THE HEAT SINK

Therefore the more effective the heat transfer between collector and the outside atmosphere the greater the dissipation rating of the transistor and hence the greater the power it can deliver.

With valve techniques, it requires expensive methods to place the plate in intimate thermal contact with a heat sink such as air or water. Hence with ordinary valves only a small increase in dissipation for a given temperature can be obtained by cooling with air blasts or the provision of cooling fins.

With transistors on the other hand it is possible to make the thermal resistance between the collector and the metal case of the transistor quite low. Effective cooling of the dissipating element can be obtained by air or water cooling or by attaching the transistor to a large mass of material with a low thermal resistance.

Certain early transistors were manufactured with large blocks of metal and/or cooling fins as part of the unit and could therefore dissipate a relatively high power even when mounted on materials with poor thermal conductivity. This approach, however, defeated one of the main advantages of transistors: that of compactness.

It has been found more practical to place the responsibility for effective cooling in the hands of the equipment designer and the larger power transistors such as the 2N250 and the OC16 are intended to be mounted on a heat sink.

Usually it is possible to make the heat sink part of the case or structure of the equipment so that extra bulk and weight can be cut to a minimum.

COMMERCIAL SETS

To summarise the foregoing, it is essential to bear in mind that a power transistor is capable of dissipating its full power only when mounted on a suitable heat sink. Since the maximum collector temperature is limited, the collector dissipation is also affected by the maximum ambient temperature to which the equipment is to be subjected.

Present commercial hybrid car receivers in the main use a single transistor in class A in the output stage. The maximum audio power output which can be obtained is a little less than half the no-signal power dissipation. In a typical case it would be safe to allow the output transistor to dissipate about 4 watts so that the maximum audio power output would be a little less than 2 watts maximum.

In order to permit 4 watts dissipation at the highest likely ambient temperature without exceeding the permissible collector temperature, part of the case of the receiver is made from thermally conductive material such as aluminium or copper and the transistor bolted to it.

The collector is usually connected directly to the case of the transistor so that it will frequently be necessary to electrically insulate the body of the transistor and at the same time provide good thermal contact. Aluminium panels are sometimes anodised to provide good electrical insulation in which case the heat transfer can be made very good especially if both surfaces are smeared with one of the silicon compounds beforehand.

Mica washers are sometimes used between the transistors and heat sink and may represent a more practical solution from the point of view of the home builder than the anodised panels. The washers can be purchased from the manufacturer along with the transistors.

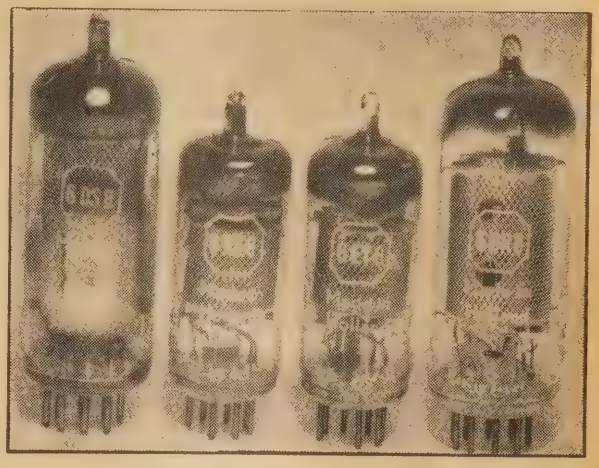
One of the several circuits for a transistor output stage suggested by Philips is published here. Philips also suggest circuits with a sliding bias system which allows higher effective power output to be obtained. The system is based on the fact that the dissipation at the collector of the transistor at full signal is only half that under no-signal conditions. The circuit requires some extra components including a germanium diode and a special output transformer but may be well worth considering.

If, for example, a power transistor is mounted on a heat sink and it is found that the maximum dissipation which can be obtained without exceeding the permissible collector temperature with the highest likely ambient temperature is 4 watts, it will be possible to obtain a little less than 2 watts of audio power under class A conditions.

Under no signal conditions, the collector dissipation will be 4 watts but at maximum output, it will only be 2 watts approx. The remaining 2 watts will be delivered to the speaker. Therefore by altering the bias on the transistor it is possible to drive it harder and assuming a transistor with "perfect" characteristics obtain up to 4 watts.

In practice the bias is altered by rectifying some of the audio output, filtering it and applying it to the base of the transistor. Sudden transients cannot be handled without distortion due to the time constant of the filter but in practice the effective output is increased to a worthwhile degree. Steady signal output in a practical case may be expected to be increased from 2 to over 3 watts.

Space has not permitted discussion of the application of transistors to the RF section of a car receiver, but we hope to cover this in a subsequent article.



Externally, the 6ES6, 6DS8, 6DR8 and 6ET6 look much the same as their counterparts designed for 250 volts plate supply. Very careful design and execution is necessary to secure good performance and reliability at the low operating voltages

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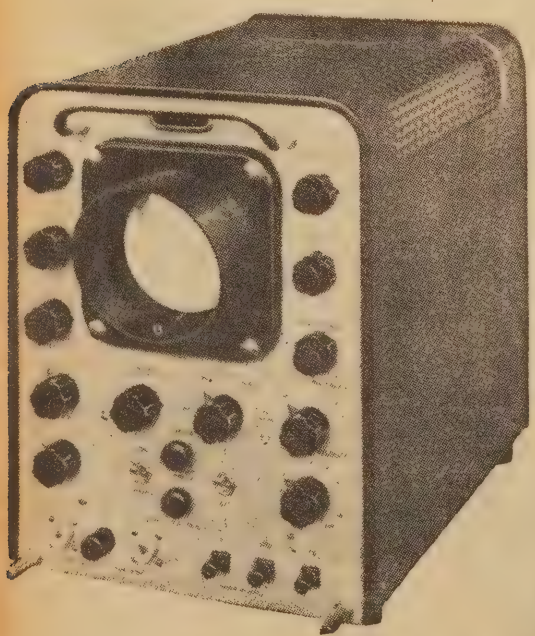

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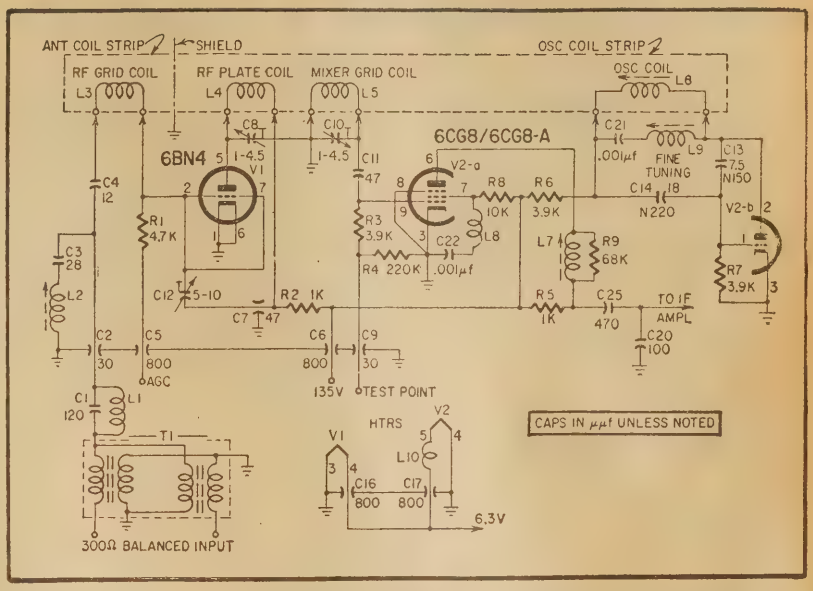
TV TUNER DESIGN IS CHANGING

Considerable development is currently taking place overseas in television tuners and this will inevitably be reflected in local production. Already, quite a number of tuners using the so-called "neutrode" RF amplifier are in circulation.



Circuit details of a typical VHF TV tuner using a neutralised triode RF amplifier stage. ("Radio Electronics")

RESEARCH on tuners in the U.S. is being accelerated as much as anything by the need to provide for the UHF channels. Ideas and techniques which have had to be developed, of necessity for the UHF bands, are having an inevitable influence on ordinary VHF tuners.

A further point is that the need to use two tuners, one acting virtually as a converter, makes it essential to conserve space and avoid the bulk which would be represented by two complete units of conventional dimensions.

The problem of size has led to the development of a tuner which employs the turret principle of channel selection but with the coils mounted radially on a disc. This results in a very substantial reduction in volume.

COMPACT CONSTRUCTION

A new disc-type tuner manufactured by the Standard Coil Company is illustrated below. It is no wider than a conventional tuner, not as high—four inches against nearly six—and only 2 inches in depth, neglecting shafts. Standard know it as their "Fireball Neutrode."

Electrically, one of the most notable steps is a reversion to a simple neutralised triode RF amplifier.

In theory at least, triode RF amplifiers have the advantage at very high frequencies, because their simpler structure and the absence of Schott effect superimposes less noise on the signal. However, their natural grid-plate capacitance has always been a hazard to be overcome.

In the past, TV tuners have used triodes as cathode followers and as grounded grid amplifiers in an effort to overcome the effects of Cg-p. Both circuits have serious limitations and, for many years, the "cascode" arrangement using two triode sections has been employed almost universally.

CASCODE DISADVANTAGES

While electrically satisfactory, the cascode also has its own disadvantages. If the two stages are to be isolated in terms of DC, the total current drain is considerable and a fair number of wiring components have to be accommodated in a very small space.

Conversely, the popular series connection, while relieving the current drain position and reducing the number of parts, necessitates the provision of a total supply voltage of at least 180. This may well be inconvenient, particularly in American transformerless receivers.

Consideration of these problems has resulted in the very old neutralised triode scheme being resurrected and successfully adapted to TV tuners. The resulting circuit is satisfactory electrically and appreciably simpler and cheaper than the conventional cascode. Its overall power requirements are also lower.

The accompanying circuit shows a complete tuner incorporating a neutralised triode RF amplifier. The 6BN4 is well suited to the purpose, having relatively low grid-plate capacitance, high transconductance and twin grid and cathode leads. These reduce series inductance and allow the designer some discretion in the way signal and neutralising connections are made.

Tracing the circuit through, the 300-ohm balanced line connects to a ferrite cored balun transformer which matches it to the nominal 75-ohm RF input circuit. This ultimately couples to the lower end of the RF grid coil through what is virtually a pi-network. Feed-through capacitor C2 acts as part of the pi-network, while C4 is selected to give the desired order of coupling.

CIRCUIT DETAILS

Components C1, L1 and C3, L2 constitute parallel and series traps aimed at preventing energy at IF penetrating the signal input circuit.

The grid coil L3 is brought into circuit by the turret and is adjusted so as to be series-resonant on the required channel with C4, C2 and the input capacitance of the valve. Since this last is the smaller quantity, a large proportion of the total signal voltage appears across it, so that an effective step-up is obtained.

A "new look" in tuners is provided by this disc type turret construction. It is much more compact than conventional tuners using a drum type turret.

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P154

The RF amplifier plate coil is also brought into circuit by the turret and is adjusted to be parallel-resonant on each band with a small trimmer C8 and the output capacitance of the valve. In practice C8 is adjusted on the highest frequency band, as much as anything to compensate for natural variations in the valve and wiring, the coils being designed to resonate with it on other bands.

The opposite end of L2 is bypassed by the feed-through capacitor C7. This is carefully chosen to give an incomplete bypassing action so that a residual RF voltage is present across it, out of phase with that at the plate. By coupling to the grid through the variable neutralising capacitor C12, the effect of direct grid-plate capacitance can be cancelled.

Literature on the tuner suggests that the use of a carefully selected feed-through capacitor for the position C7 makes a substantial contribution to the practicability of the circuit. Effective neutralisation on all channels would not be possible if C7 caused a certain amount of inductance to be common to the plate and grid circuits

DEVELOPED FOR CIRCUIT

The 6BN4 type of valve is likewise much more amenable to neutralisation than earlier types.

In practice, the neutralising trimmer is adjusted after the receiver has been set up for normal sweep circuit alignment. A cut-off bias is applied to the valve and the neutralising capacitor adjusted for a null in signal level.

Mutual coupling between L4 and L5 provide the signal input path to the mixer grid, the coupling being arranged to provide the necessary bandpass. L5 is parallel resonant with C10 and the input capacitance of the mixer valve, the circuit being adjusted in the same way as described for L4.

Another interesting trend apparent in this tuner is the use of a variable inductor shunting the oscillator coil instead of the usual variable capacitor fine tuning control. It is seen as L9, shunting the turret coil L6.

Particular advantage of this scheme is that the fine tuning range can be kept much more even between the various channels. Whereas the capacitive control is much sharper on the high channels than on the low, a shunt inductor can give the same "feel" on all channels.

MIXER STAGE

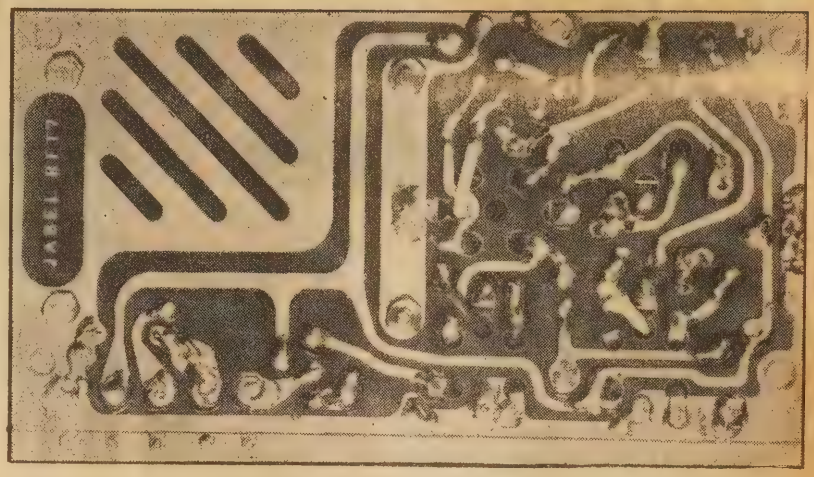
The mixer is a pentode, operating with grid-leak bias, provided mainly by oscillator injection.

A test point at the junction of R3 and R4 is available for DC measurement, for IF injection and also for sweep display of a signal after passing through the RF amplifier stage. This is made possible by the fact that the grid circuit provides rectification of the input signal.

Another interesing point is that a small inductor is connected in series with the screen bypass. This produces some regeneration on the higher frequency channels and tends to give a more even gain over the whole tuning range.

IF output is taken across a capacitor, rather than from a link. Inductor L7 is resonated by C25, C20 and the output capacitance of the pentode mixer. A small proportion of the signal voltage is developed across C20 and made available to the IF channel, simulating a tap on the coil or a low impedance winding.

TRANSPORTA-7 PRINTED BOARD



Everyday use ot the "Transporta Seven" receiver, described in the February issue, has confirmed our claims that it is a very practical type of portable set with good range and ample volume and so economical that battery drain can virtually be forgotten

ONE ot the problems at the time when it was developed was that of mechanical construction, since transistor circuits do not lend themselves to the usual metal-chassis technique which has been current for so many years

The chief reason for this is that transistors do not normally fit into sockets, as do valves, and the usual array of circuit tie points provided by the socket lugs is missing. As a result, a considerable number of tagstrips may be required to support the transistors and wiring components, the bulk of the strips being virtually as great as the components they support

Appreciating this problem, the original tuner was built up on a flat bakelite sheet with small eyelets to support the components on top and also to provide terminal points for the physical wiring underneath.

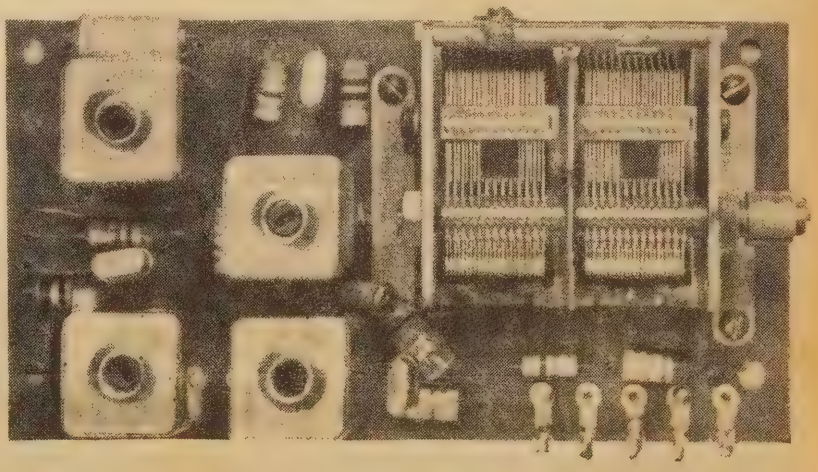
While this is a perfectly practical method of construction, which could have been duplicated by anybody wishing to do so, it was also intended to serve as a prototype for an actual printed circuit board, in which the eyelets and physical wiring would be replaced by a printed copper pattern We expressed the hope that such a board would make its appearance.

In fact, a printed board designed especially for the "Transporta Seven" has now been made available and makes assembly of the tuner a very simple matter indeed. A typical tuner using this board is pictured herewith

Because of the extra stage, components on the board are grouped more closely than in the earlier and simpler tuner and a little more care is required, particularly where one component mounts above another. Unused lugs in the IF transformers have to be clipped off, rather than just bent over, to minimise risk of shorting.

As bought over the counter, the board is accompanied by an instruction sheet relating expressly to the "Transporta Seven" and indicating exactly where each component should be placed.

A point of note is that the copper has been etched away from the mounting holes to permit the board to be insulated from the metal base in special circumstances. This is not necessary in the original Transporta receiver and metal washers may be used to ensure definite earthing.



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ABOUT THE ELUSIVE WHITE LINE

A fairly common fault in television receivers, both commercial and home-constructed, is a faint, wavering, whitish line running across the picture, from top to bottom. It appears and disappears in the most disconcerting fashion and often resists all efforts to eliminate it.

By NEVILLE WILLIAMS

WE had heard about the trouble and seen it on odd occasions, but never met it on the bench till just recently — hence this present article.

The whitish line we have in mind is not the variety due to overdrive of the line output stage. An overdrive line is normally stationary at about one-third to one-half the distance across the screen from the left-hand side. It is clearly defined, usually straight and vertical and is not affected to any extent by operation of the fine tuning or contrast controls.

It is caused by a discontinuity between the reaction and driven scan and careful inspection will usually reveal noticeable compression of the picture information within the offending area.

The trouble disappears completely and abruptly when the sawtooth drive voltage to the line output grid is reduced.

Nor is the whitish line to be confused with the vague variations in brightness which are sometimes apparent on a blank raster when one program has been faded out and the next is somewhat delayed. This effect is fairly common and is probably due to a slight cyclic variation in EHT voltage and possibly scanning rate, arising from the highly inductive deflecting circuits.

NOT IMPORTANT

This effect can usually be ignored, since it is not apparent with a normal picture on the screen and, therefore, does not detract from the performance of the set.

The whitish line we have in mind is usually vague and wavery in character and it may move across the screen or even disappear altogether with adjustment to the fine tuning, the line hold or the contrast control.

It is sometimes apparent on all channels, but, in other cases, seems to be prevalent only on certain channels. It shows up most clearly on a blank raster or when it coincides with large flat areas of illumination, but is not accompanied by any expansion or compression of the relevant picture information.

It is commonly referred to as a "spook" line, presumably because of its rather ghostly appearance and behaviour.

Many explanation have been advanced to account for spook lines, some of them likely, others just the reverse. These include:

(1) A sharp ripple or rise in the EHT voltage, producing increased brightness at a particular spot on each scanning line and, therefore, building up a complete whitish, vertical modulation bar.

This theory is an unlikely one, because the result would be much more akin to an overdrive line, with simultaneous compression of the picture information. It would occur at the same point in each scanning line and be relatively unaffected by adjustment of the aforementioned controls.

In any case, it seems likely that the time constant of the EHT filter would be too long to permit such a sharp rise in voltage.

(2) It is produced by a harmonic wave train from the very angular 15Kc waveforms in the line output circuits, which happens to fall into an active channel or into the pass-band of the IF system.

At first glance, this theory seems to tie in with the rather unpredictable nature of the fault and with the general idea that it is somewhat affected by tuning, by alignment procedures and by manipulation of the aerial feeder.

Modern receiver designs specify suitable shields and filters (the latter often called spook suppressors) specifically aimed at this type of interference. If then, a spook persists in spite of these precautions, there appears to be little point in fitting additional filtering or shielding. This is particularly so if, as in this case, there is no evidence of white modulation pips in the output of the video amplifier.

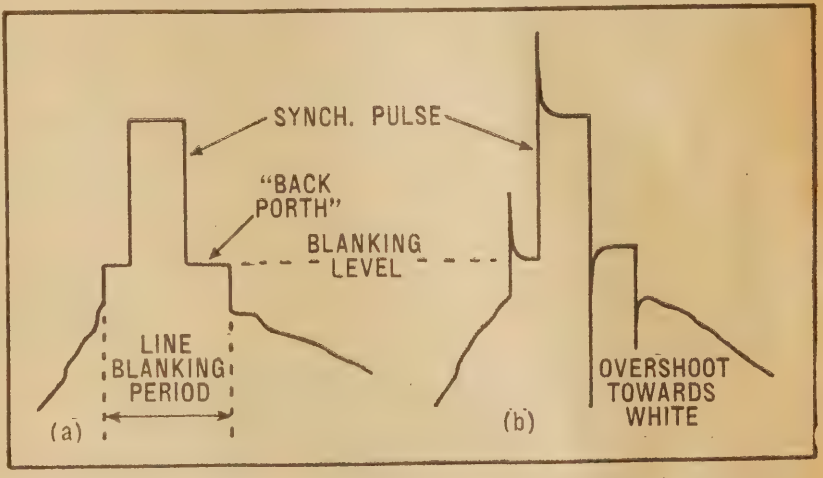

Figure 1: Diagram (a) indicates the normal shape of the line synch. pulses while (b) shows how the pulses are affected by overshoot. The downward spike from the trailing edge is suggested as a frequent cause of "spook" lines

(3) If not present in the output of the video amplifier, the modulation pulse is introduced via one of the other electrodes in the picture tube.

This sounds like a rather long shot and, again, there is not much evidence of such stray modulation having ever been identified or the subject of special precaution.

When, as mentioned earlier, we did at last come up against a spook line on our own bench, the foregoing possibilities were examined and rejected, leaving an explanation still to be found.

The first vital clue to the nature of the fault came from a careful inspection of the affected picture. Whereas vertical lines in the picture tended to lean very slightly to the left near the extreme top, the white line leaned by a much greater amount to the right. Manipulating the line hold control to accentuate the lean caused the spook line to spill away to the right.

This indicated that the spurious information was not superimposed on the picture at all but on the retrace line!

It checked, too, with some observa-

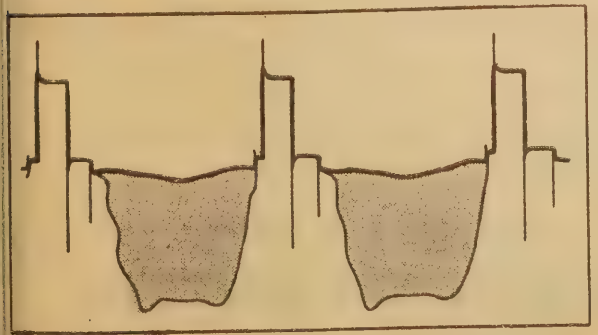

Figure 2: A sketch of the waveform from ABN Channel 2, at the picture tube cathode of a receiver suffering from a white "spook" line. Essentially the same pattern was evident at the detector.

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The ACOS Pillotone enables the individual listener to enjoy Radio programs or relayed music in comfort. It replaces headphones with their irritating entangling leads and allows the listener to relax, head comfortably settled on a cushion or pillow, enjoying a program which is heard by the individual alone. Although giving the reproductive quality of a normal loudspeaker, it is inaudible three yards away

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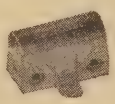

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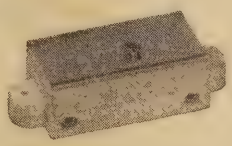

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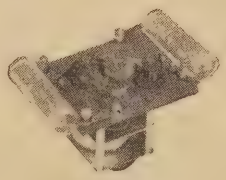

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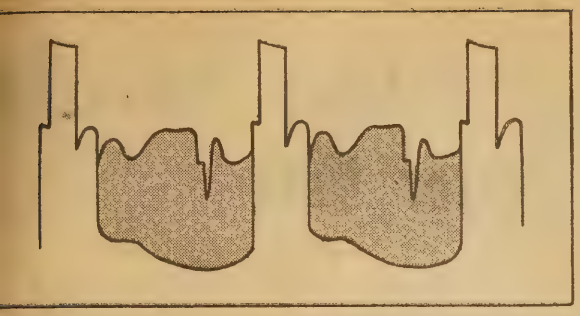

Figure 3: A sketch of the waveform from TCN Channel 9. Note that there is very little sign of overshoot. The reason for the difference between this and figure 1 is not immediately obvious.

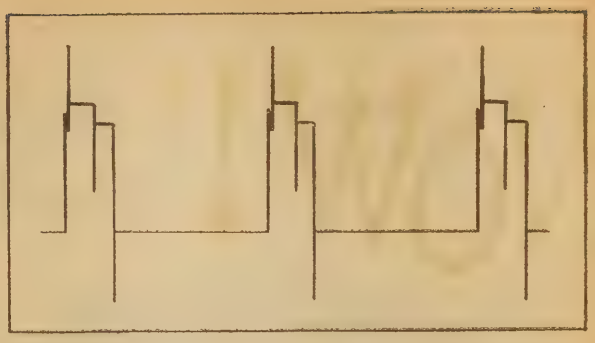

Figure 4: Neither of the pattern generators available would produce overshoot in the normal way but deliberate mistuning produced very large spikes, as indicated.

ons in a recent copy of "Radio and TV lews," discussing this and other faults typical American commercial reeivers. One of the illustrations showed ne familiar white spook line, exactly as the receiver under test.

Having identified the white line with ne retrace period, the rest of the exlanation follows readily enough.

Figure 1a indicates the nature of the ne synchronising pulse, which extends ove the blanking level by an amount epresenting the range 75-100pc. of the eak carrier amplitude. The blanking eriod between successive lines of video formation is longer than the actual nch. pulse, the difference between the vo forming what is commonly called ne "front porch" and the "back porch."

In a receiver operating normally, the verall shape of the blanking and synch. ulse is preserved reasonably well and n be seen as such with the aid of a od quality oscilloscope. However, if ere is a tendency to overshoot anyhere in the receiver, all vertical edges n exhibit the effect indicated in figure

FFECT OF OVERSHOOT

Overshoot on the leading edge of the lanking pulse and of the synch. pulse n produce erratic behaviour of the nch. separator, but that is not our mediate concern. What is of concern the downward overshoot from the ailing edge of the synch. pulse, which roduces a spike extending well beyond ne blanking level into the grey region.

At this point, which will be part way ong the return trace, the spot is made sible for an instant and, since it occurs n each line, it can produce a whitish ar. Furthermore, because of the high etrace speed, very slight time irregurities will cause considerable displaceent of the spot — hence the rather avery, curved appearance of the interrence pattern.

Such was the theory. Could it be emonstrated in the faulty receiver?

The C.R.O. soon provided the answer this question.

Figure 2 is a sketch of a waveform opied from the CRO screen and produced by a signal from ABN, Channel 2. lote how overshoot from the rear of the ne synch. pulse has formed a spike exending well down toward the white evel of the video signal, exactly as sugested.

By way of further confirmation, another white line was found at the extreme ft of the picture, corresponding to the ownward spike from the blanking pulse. his had not been noticed earlier and is not normally seen, being off the active screen area or hidden by the mask.

The height of the spikes in relation to the video information could be seen to vary with the setting of the fine tuning control, the white line becoming correspondingly more or less obvious.

It should be stressed in passing that such overshoot effects will only be portrayed accurately on a CRO capable of being synchronised to line information and having a flat passband to 1Mc or higher. Inadequate response will fail to resolve the spike, while a peaky response could be misleading by itself generating overshoot.

Having thus observed the effect, the next problem is to find the cause and take remedial action.

An obvious suggestion is that it is due to over-peaking of the video detector and amplifier but our observations all indicated that it was not as simple as this. Whereas the waveform from Channel 2, as shown, exhibited considerable overshoot, ATN Channel 7 showed only about half as much and TCN Channel 9 hardly any at all

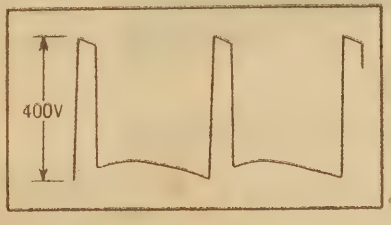

Figure 5: The waveform across the width coil looks eminently suited to line retrace blackout but it cannot easily be utilised in a simple video amplifier system.

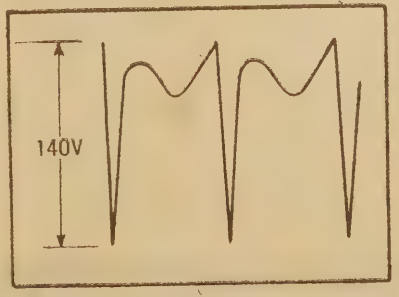

Figure 6: The waveform across the sine-wave oscillator coil is not ideal for retrace blanking but its polarity and potential allows it to be applied directly to the first anode of the picture tube.

This suggests the possible operation of at least three possible factors:

(1) Detector and video amplifier overshoot, as already mentioned.

(2) Overshoot arising in the IF and tuner system, modified by different characteristics on different channels.

(3) A difference in the "rise time" of the pulses as transmitted, aggravating or otherwise the tendency to overshoot in the receiver.

Taking these matters in order, a well designed video system should not exhibit marked overshoot but variations can occur in production which may escape notice. The obvious causes for this would be variations in shunt capacitance, due to changes in the wiring method and variations in the inductance and "Q" of peaking coils, due to turns or core material.

VIDEO OVERSHOOT

The question of video overshoot in relation to R, TV and H receivers was discussed in the July, 1958 issue (page 71). It was suggested that, as a general precaution against video overshoot, the 330uH detector peaking choke be shunted with a 4700 ohm resistor and that a 3300 ohm resistor be connected across the 150 uH video plate choke.

If trouble is being encountered with a "spook" line, it may be as well to add these components as a matter of course. In commercial receivers, the circuit and values may differ, calling for other measures.

The fact that shunting or shorting the peaking chokes reduces the amplitude of the spike must not, however, be accepted as prima facie evidence that the video amplifier is at fault. Eliminating the peaking circuits will reduce the high frequency response and therefore the amplitude of the spikes, irrespective of their origin.

In actual fact, in the receiver under test, the spikes were equally evident at the output of the video detector, using a cathode follower probe and a purely resistive load. The same pattern was evident—prominent spikes on ABN, less prominent on ATN and hardly noticeable on TCN.

An effort was made to simulate the effects using test instruments but neither of the commercial pattern generators available would produce spikes unless deliberately mistuned with respect to the pass-band. By this means spikes could be produced on all channels (figure 4) but the conditions were too artificial to mean very much. Nor were we able to demonstrate sufficient difference between the passbands on the various channels

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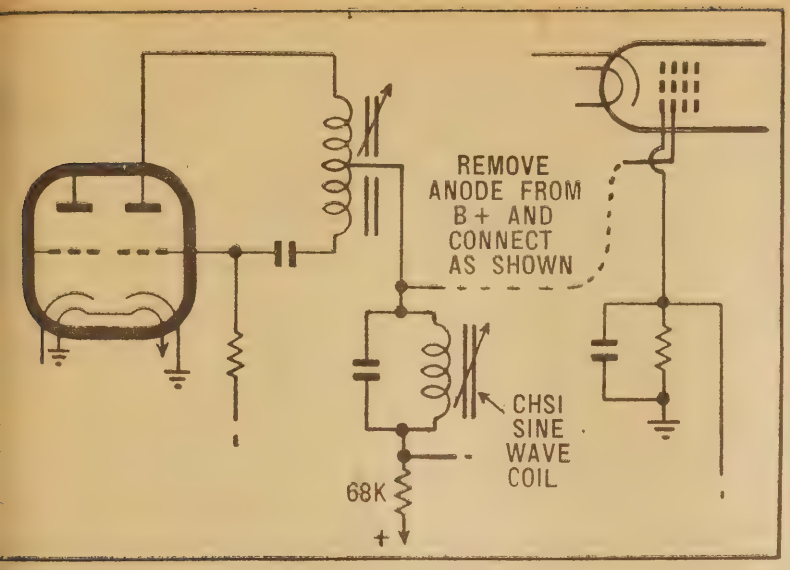

Figure 7: This simple circuit may eliminate "spook" troubles in many receivers using the synchroguide type of line oscillator. In other cases, the provisions of line retrace blanking may be more difficult.

account for the difference between BN, ATN and TCN.

The logical conclusion from this is hat the tuning system of the receiver ad an inherent tendency to overshoot, ue possibly to a lapse in the basic de-gn, to excessive component tolerance, regeneration or to non-optimum ignment.

Further, that the tendency was aggra-ted or ameliorated by slight differ-nces in the rise time of the synch. ulses, as transmitted.

Unfortunately, none of these sugges-ons or factors are of much practical elp to homebuilders or even radio ser-cemen, because a complete analysis of tuner and IF system demands a gen-rous quantity of time, resource and test quipment of the highest quality.

In the normal way, it is problem nough to ensure even nominally correct ignment.

If overshoot does occur and a "spook" he results, it may or may not yield to ignment. What little we have seen of suggests that very prominent lines will bside to the role of a minor fault after e overall response curve of the tuner F system has been flattened and broad-ned to approximate the ideal band-pass hape.

However, it equally suggests that the chievement of such a shape will not of self be a guarantee of freedom from vershoot and a consequent "spook" he, even though picture quality may herwise appear to be above reproach.

OME OTHER COURSE

Some other step is therefore called for eliminate the hazard.

The obvious course is to apply to he line deflection circuitry what is al-eady commonly done for the frame—amely to apply a black-out pulse to the eturn trace from within the receiver, nite independently of the transmitted lanking pulse. By making the internal lanking signal large enough, it can vamp any factor which might other-ise render the return trace visible.

In many receivers a rectangular pulse f very high amplitude is present across he width coil (figure 5) and, at first lance, it seems to provide a ready answer to the question of retrace blank-ing.

In fact, however, it is not practicable to apply the pulse to the picture tube cathode or to any other point in a single-stage video amplifier which will not simultaneously inject it into the synch. separator stage. This would be highly undesirable, if not disastrous.

Nor can the pulse be fed too easily into the grid of the picture tube. Quite apart from the fact that the grid is al-ready connected to the frame retrace blanking circuit, the line pulse available has the wrong polarity and would need to pass through a phase reversing ampli-fier.

SIMPLE SOLUTION

This last objection applies also to the idea of feeding the pulse to the first anode. Short of providing additional circuitry or of adding special com-ponents, the very promising width coil pulse has to be passed over.

However, in receivers using the syn-chroguide line circuit (these include the R, TV & H. receiver designs) a pulse of less-than-ideal but still adequate shape is present in the oscillator anode cir-suit, at the junction of the oscillator and sine wave coils.

By simply lifting the present first anode connection of the picture tube from the B-plus line and running it to the top of the sine wave coil, a sharp reduction in picture tube brightness is effected during each line retrace period.

Already reduced by alignment to moderate and typical brightness, the "spook" line in the sample receiver was completely eliminated by this very simple method of retrace blanking. No visible effect could be seen on the for-ward trace. It may therefore provide the answer for TV set builders who have experienced trouble of this nature. In any case, it is a very simple matter to test, since it involves only re-routing one wire.

Figure 7 shows the circuit change necessary.

As far as we can see, there is no reason why the same amendment could not be made, where necessary, to com-mercial receivers using similar circuitry and showing "that elusive white line."

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This article is concerned with circuits which derive the control potential from the incoming signal. The problem of A.G.C. in a receiver designed for a negatively modulated system is discussed in terms of a representative selection of A.G.C. circuits. It is shown that the dependence of the correct A.G.C. potential on the line timebase synchronisation is undesirable, since it can make the receiver more difficult to operate and can also result in lock-out.*

A simple high-gain circuit is described which is free from this fault and, in addition, permits improved video amplifiers to be designed. The A.G.C. potential is dependent on the black level of the signal and is completely independent of the line timebase frequency (line hold control). In addition the circuit has the following advantages:

(i) It is D.C. coupled and completely free from lock-out, paralysis or blocking.

(ii) The input impedance is high and no significant capacitive load is added to the video amplifier.

(iii) The circuit uses relatively few valves and components and does not depend critically on valve characteristics or component tolerances.

(iv) The principle of synchronising pulse cancellation is used in the gate circuit which increases the immunity of the circuit to impulsive interference.

**This article is extracted from Mullard Technical Communication Vol. 4, No. 33.*

A.G.C. Circuits For Television Receivers

The signal received at the aerial terminals of a television receiver may change for a variety of reasons such as fluctuation in propagation, reflections from aircraft and different signal strengths for different transmissions (different programs). The installation and operation of the receiver is greatly simplified if the amplifier gain is automatically adjusted so that the picture has satisfactory contrast in a wide range of circumstances.

FOR a receiver to accept a wide range of input signals, without visible alteration of picture drive, a high-gain receiver is essential in addition to a high-gain A.G.C. system.

The rate of control for a typical receiver having three I.F. stages and controlled on the R.F. and two I.F. stages is about 11dB/volt. Thus to obtain about 80dB of control some 10 volts of A.G.C. bias is required, allowing 3 volts for the R.F. delay. This range of automatic control is only possible with an amplified system.

If it is very important, however, to ensure that the A.G.C. circuit itself is free from drawbacks. At the same time the performance of the receiver in "difficult" locations (for example, close to a main road) should still be satisfactory.

The simplest form of A.G.C. circuit is operated from the video detector (Fig. 1). The video signal is negative-going, the tips of the synchronising pulses being the most negative component corresponding to the maximum output from the transmitter. The negative D.C. component is filtered (R1C1) and used to control the gain of the I.F and R.F. amplifiers. Such a simple solution, however, has three serious disadvantages, namely:

(i) The gain of the system is low since the change in A.G.C. potential is proportional to the variation in the video detector signal. Thus a wide range of automatic gain control is not possible.

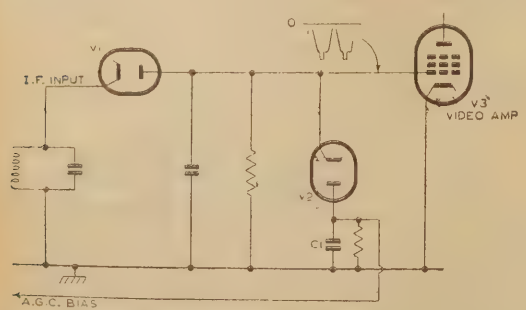

Fig. 2.—Peak-detector A.G.C. Circuit.

(ii) The A.G.C. potential is not only dependent on the received signal amplitude but also on the video information. This produces an effect similar to A.C. coupling the video signal. To prevent the video information, in particular the 50c/s frame blanking, from remodulating the R.F. signal a long time constant must be used.

(iii) The A.G.C. circuit is slow acting, on account of the long time constant, and cannot follow fast variations in the received signal.

It is common practice in receivers designed for a positive-modulation system (the British 405-line system) to utilise the D.C. component of the video output signal at the control grid of the synchronising pulse separator for the A.G.C. bias potential. The video signal at the grid is negatively D.C. restored by grid current and the use of the video output signal results in a higher effective gain.

SUBJECT TO LOCK-OUT

However, with a negatively modulated signal, this circuit is very susceptible to "lock-out" when a sudden signal change is made, for example, by switching to a local station. The sudden increase in signal overloads the video amplifier, cutting it off before the A.G.C. potential is able to develop; since no video output signal is produced no A.G.C. bias is developed, and there is a lock-out.

A circuit similar in some ways to the mean-level circuit is the peak detector (Fig. 2). The tips of the video signal are rectified by the peak detector V2 which charges C1 to a D.C. potential equal to the peak signal amplitude. This D.C. potential is used as the A.G.C. potential.

A delay potential is often applied to the anode of the peak detector to prevent

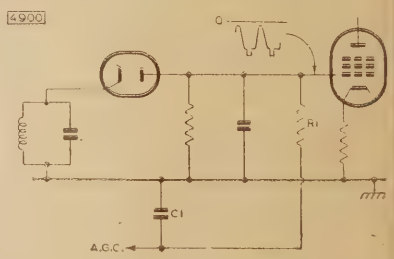

Fig. 1.—Mean-level A.G.C. Circuit

the diode from conducting on small signals. This potential is often adjustable and forms the contrast control. The gain of the circuit is still low, but the A.G.C. potential is proportional to the received signal potential and not to the video information.

With a negatively modulated system, noise pulses often extend above the tips of the synchronising signal. Such pulses charge C1 to the peak value, causing the A.G.C. potential to "ride-up." This results in a lowering of the contrast and brightening of the picture following a burst of interference.

The effect can be minimised by using a filter circuit with a long time constant, but the A.G.C. system is then not able to follow fast variations in signal strength, such as those caused by aircraft.

To increase the loop gain of the system a pulse-operated amplifier is often

used. A simple form of the circuit employing cathode coupling is shown in Fig. 3. Its operation is as follows: The video signal from the cathode of the video amplifier is applied to the cathode of the grounded-grid pulsed amplifier. The amplifier is pulsed into conduction by a positive pulse obtained from the line timebase. The anode current charges the coupling capacitor C1, producing a negative potential at the anode. The anode current is dependent on the grid-to-cathode potential at the instant of the pulse.

Providing the line timebase is correctly synchronised the anode current is controlled by the D.C. level of the line synchronising pulses. The negative potential at the anode is smoothed by C2R2 and used as the A.G.C. potential.

A positive delay potential is applied to the cathode of the pulse amplifier to prevent it from conducting and producing an A.G.C. potential with low signal inputs. Varying this potential (by means of the contrast control) enables the level of video signal at which the gate circuit operates to be adjusted. In practice this potential may be adjusted by varying the cathode current of the video amplifier, often by varying the screen-grid potential.

NOISE IMMUNITY

Noise pulses can only affect the A.G.C. potential if they occur at the instant the amplifier is pulsed into conduction. Thus the noise immunity of this type of circuit is good.

The effective gain of the system, however, depends on the working point of the video amplifier at the tips of the synchronising pulses. The circuit also depends for its correct operation on the synchronisation of the line timebase, since this provides the gating pulse.

The effective gain of an A.G.C. system can be increased by deriving the control potential from the output of the video amplifier. A typical gate circuit is shown in Fig. 4. The video signal is applied to the control grid from the anode of the video amplifier via R1. This resistor is used to prevent excessive grid current and in conjunction with the input capacitance of the valve to remove H.F. noise from the video signal, and also helps to reduce the capacitive load on the video amplifier.

The valve is pulsed into conduction by a large positive pulse from the line output transformer. The anode current charges the coupling capacitor C1, producing a negative potential at the anode. The anode current is dependent on the grid-to-cathode potential at the instant of the pulse. Providing the line timebase is correctly synchronised, the anode current is controlled by the D.C. level of the line synchronising pulses. The negative potential at the anode is smoothed by C2R2 and is used as the A.G.C. potential.

A positive delay potential is applied to the cathode of the amplifier which prevents the valve from conducting and producing an A.G.C. potential with low signal inputs.

Varying this potential enables the level of the video signal at which the gate circuit operates to be adjusted. If this potential is made more positive a larger amplitude of video signal is required to operate the gate circuit. Adjustment of this potential therefore forms a convenient contrast control.

The effective gain of the circuit also depends on the working point of the video amplifier and the circuit depends on the synchronisation of the line timebase for its correct operation.

From the gate circuits described so far it will be noted that lock-out can be produced as follows: The A.G.C. potential only has the correct value if the line timebase is correctly synchronised. If the line synchronising fails, the A.G.C. amplifier is pulsed into conduction on the video signal.

Since the video signal is more negative than the tips of the synchronising pulses the A.G.C. potential is reduced in value, increasing the amplitude of the video signal. If the contrast control has been adjusted to obtain a large video signal the increase in amplitude can overload the video amplifier.

Since the video input is negative-going the overload reduces the amplitude of the synchronising pulses, or results in the complete removal of the pulses through the video amplifier being cut-off by them.

The loss of the synchronising pulses prevents the line oscillator from pulling into synchronism. The receiver therefore remains in this condition until manual adjustment of the contrast control increases the A.G.C. bias and removes the overload in the video amplifier.

This effect is often called lock-out or blocking. Lock-out may occur each time a receiver is switched on, or when the channel switch is operated. If the full D.C. component of the video signal is applied to the cathode-ray tube the overload results in the picture blacking-out. Upon changing stations or switching-on, therefore, the user may be presented with a blank screen.

One method of preventing the form of lock-out just described is to ensure that the video amplifier can never be

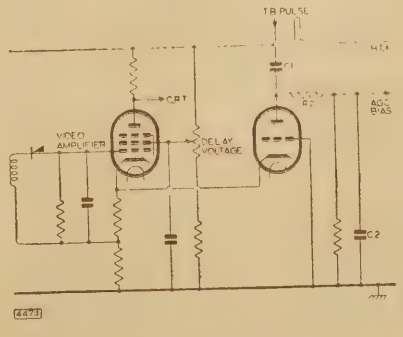

Fig. 3.—Cathode-coupler A.G.C. Gate

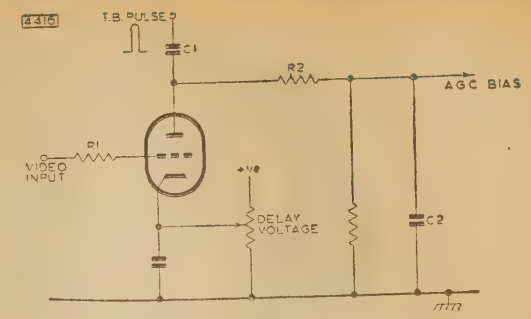

Fig. 4.—Pulse-operated A.G.C. Amplifier

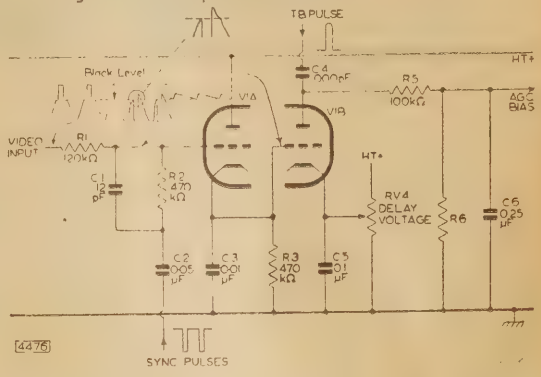

Fig. 5.—Gate Circuit with Sync. Pulse Cancellation followed by D.C. Amplifier.

overloaded. This may lead to an uneconomical design, however, since the full current swing cannot be used under normal operating conditions.

Quite apart from this consideration, if the full current swing is used the tips of the synchronising pulses approach cut-off under normal working conditions. The change in level caused by variation in the input signal is therefore small resulting in a poor A.G.C. characteristic.

A method often used to prevent lock-out consists in combining mean-level A.G.C. from the video detector with gated A.G.C. from the video output. If the line timebase synchronisation fails, the negative potential at the video detector, which would normally increase and overload the video amplifier, controls the receiver gain.

LINE OSCILLATOR

A method often used to ensure that the line hold is adjusted to the centre of the catching range is to remove the synchronising pulses when the hold control is adjusted. This technique is very satisfactory in this respect but it cannot be used with a normal line-gated A.G.C. system, since when the line timebase is unsynchronised the A.G.C. potential varies violently and the user may not know how to interpret the result.

From the foregoing discussion of some A.G.C. circuits and their shortcomings, the requirements of an A.G.C. gate can be summarised as follows:

(i) The A.G.C. bias should be independent of the line timebase synchronisation (line hold).

(ii) The circuit should not require critical valve characteristics or component tolerances.

(iii) It should have a high gain so that the A.G.C. potential can be produced with a minimum variation in video signal.

(iv) It should be stable under all operat-

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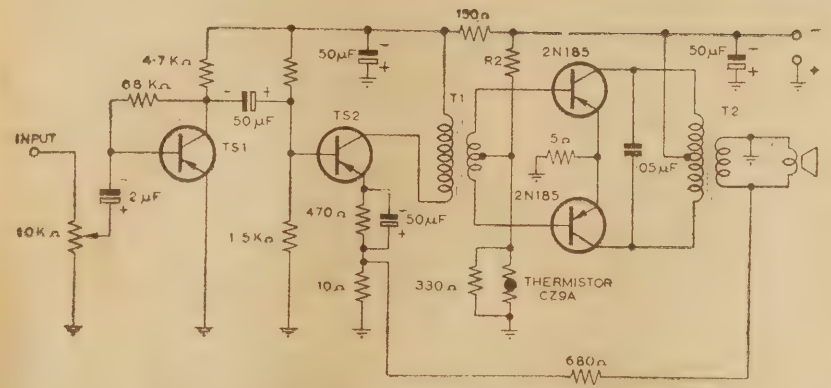

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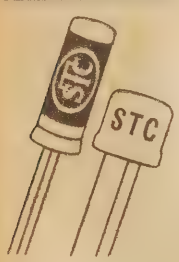

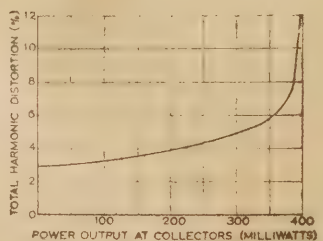

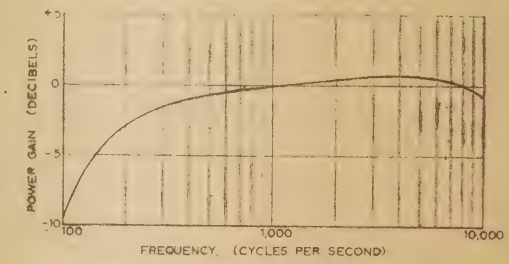

This circuit, which has been extensively tested, was designed to make full use of the performance of S.T.C. transistors, used with standard commercial components.

Output power depends upon supply voltage and impedance presented to the collectors of the output transistors, and some typical examples are shown. Temperature stabilisation is provided in each stage and includes the use of a thermistor in the output stage.

Typical Performance, Using Commercially-available Component

Collector-to-Collector Load (ohms)	Supply Voltage (volts)	Driver Transformer Ratio	Bias Resistor R1 (ohms)	Bias Resistor R2 (ohms)	Heat Sink	Power Output (milliwatts)
500	6	3000 1300 C.T.	10K	8·2K	No	140
	9	3000 1300 C.T.	12K	12K	No	250
375	6	3000 2000 C.T.	7·5K	8·2K	No	180
	9	3000/2000 C.T.	10K	12K	No	300
300	6	3000/2000 C.T.	7·5K	8·2K	No	230
	9	3000 2000 C.T.	10K	12K	Yes	350

Overall Power Gain—approximately 78 db

Driver Transformer:
Ratio: as shown.
Primary D.C. resistance: 1500 ohms total.
Secondary D.C. resistance: 80 ohms total.

Output Transformer:
Ratio: as shown.
Primary D.C. resistance: 3% of load impedance.
Secondary D.C. resistance: 3% of voice coil impedance

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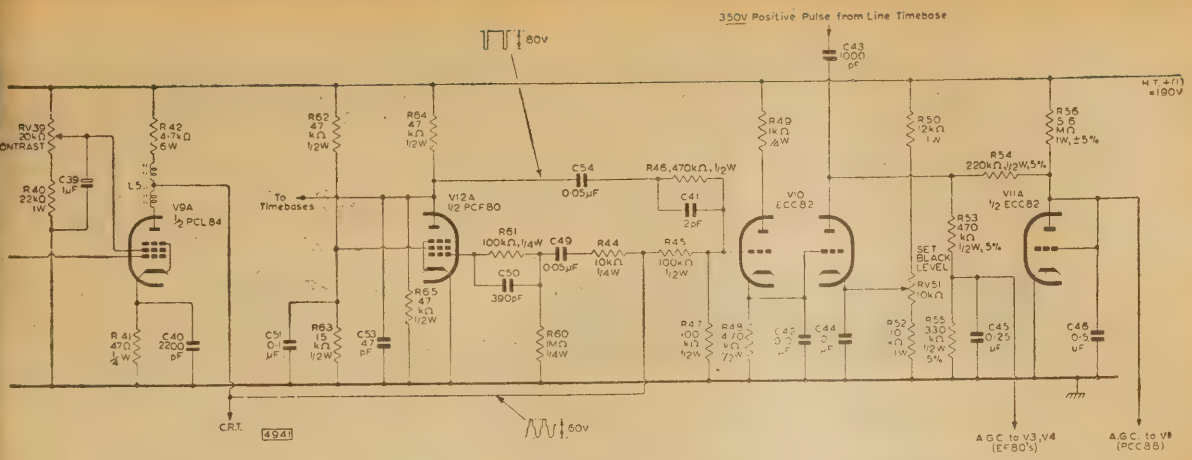


Fig. 6.—Video Amplifier, Sync. Separator and A.G.C. Circuit.

ing conditions and completely free from lock-out or blocking.

(v) It should be immune from the effects of impulsive interference.

(vi) The A.G.C. should simplify the operation of the receiver.

To obtain a high loop gain the A.G.C. voltage should be derived from the video signal output. Because of the sense of the signal change at the video output, and its D.C. level, some form of pulsed amplifier is necessary. The A.G.C. potential has to be independent of the line timebase synchronisation and therefore a pulse amplifier operated by the timebase cannot be used as a gate.

NOISE CANCELLATION

An important advantage of a line-gated system is its immunity to impulsive interference. If the above considerations preclude the use of a conventional gate, then some other method of reducing the effects of impulsive noise, such as a cancellation technique, must be employed.

Furthermore, an A.G.C. system should maintain the black level of the signal constant at the output of the video amplifier. The problem therefore is to relate the A.G.C. potential to the black level occurring in the back porch of the video signal in the best possible manner. (This is particularly important in a colour receiver.)

A simple method of exposing the back porch of the video signal is to cancel the synchronising pulses by the negative pulses at the anode of the synchronising pulse separator.

The most positive component of the resulting waveform is the black level, which can be measured by a simple peak detector. The output of the peak detecor is a D.C. potential which corresponds to the black level of the video signal. This potential can be used to control a simple pulse-operated amplifier.

FROM BLACK LEVEL

If the A.G.C. potential is derived from the black-level reference information following the line synchronising pulses, the loop gain is slightly lower, since the black level (or suppression level) corresponds to approximately 75 per cent of the transmitted power. The loss of gain, however, is not significant.

The circuit diagram of the gate circuit based on the principles described above is shown in Fig. 5. The video signal from the video output stage is D.C. coupled to the control grid of the peak detector V1A via R1. The synchronising pulses are cancelled by the negative-going pulses from the anode of the synchronising pulse separator. They are a.c. coupled to the grid by C2R2.

The peak detector V1A charges the cathode capacitor C3 to the peak potential of the grid waveform (black level). During the line period there is some decay in this potential since the cathode time constant must be fairly short to obtain a fast-acting system. Variation of the video signal close to the black level during the line can therefore influence the output of the peak detector.

In a non-amplified system the effect would be negligible but in this circuit the peak detector is followed by a pulse-operated amplifier. A small differentiated synchronising pulse is therefore added to the composite waveform at the grid of the peak detector by C1.

SLIGHT OVERSHOOT

This produces an overshoot on the waveform at the grid in the form of a positive pip on the back porch of the synchronising pulse (black level), as shown in Fig. 5. The cathode capacitor C3 is therefore charged to a potential corresponding to the peak of this pip or overshoot.

Variation of the video signal close to black level is therefore unable to influence the output from the peak detector in spite of the small decay in the cathode potential during the line period.

The D.C. cathode potential, which corresponds to the black-level potential of the video signal, is applied to the control grid of the pulse amplifier V1B which operates in the same way as the conventional gate circuit (Fig. 4). The positive delay potential is again applied to the cathode.

The pulses from the line timebase are only used to operate the D.C. amplifier and therefore the synchronisation of the timebase does not affect the A.G.C. bias.

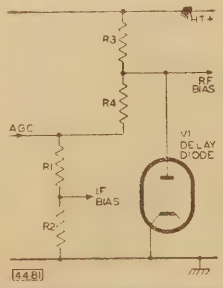


Fig. 7.—Distribution Network for use with I.F. Valves having sharp cutoff.

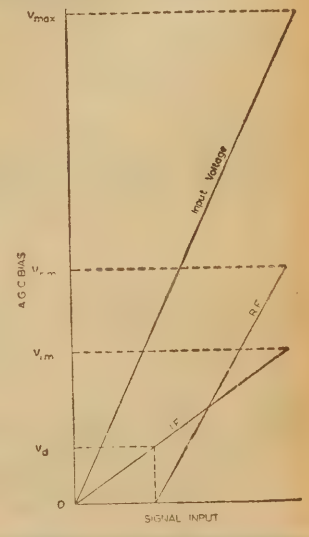
Since the video information to operate the A.G.C. circuit is obtained from back porch of the video signal, the tips tips of the synchronising pulses may reach the cut-off point of the video amplifier and the A.G.C. circuit will still operate satisfactorily. Interference pulses cannot affect the A.G.C. bias since they cancel in the same way as the synchronising pulses. Blocking of the synchronising pulse separator, and the consequent loss of the separated synchronising pulses, must however be prevented.

This can be accomplished in several ways. Operation of the video amplifier so that the tips of the synchronising pulses are close to cut-off automatically limits interference pulses to the level of the synchronising pulses. Alternatively a double-time constant network may be used in the grid circuit of the synchronising pulse separator, as shown in Fig. 6 (components R61C50 and R60C49).

In order to obtain the best noise factor at low signal inputs it is desirable not to control the R.F. amplifier. The R.F. amplifier should only be controlled when the signal level is such that increased noise from the R.F. amplifier does not increase the noise output from the receiver.

With a negative-modulation system,

(Continued on Page 87)



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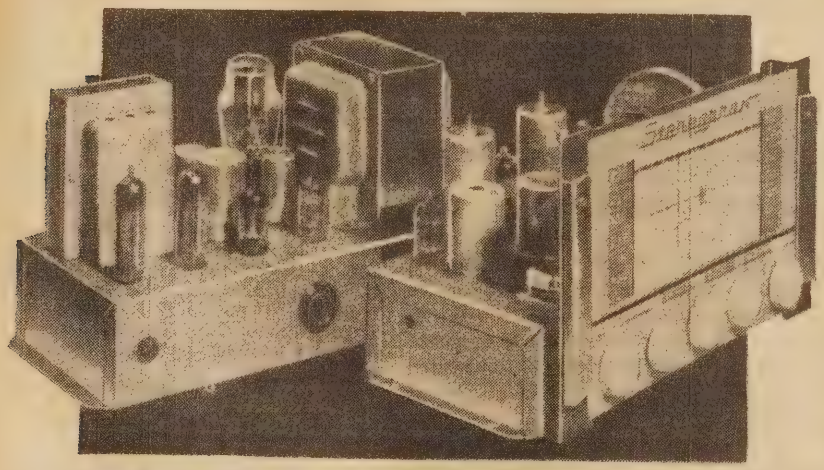

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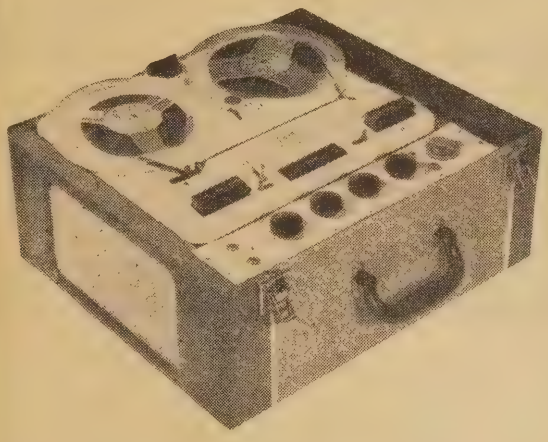

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5C	1	13	6	10-3G	2	15	0
5Cx	1	18	0	12K	3	6	0
5F	2	2	6	12M	4	1	0
5FX	2	5	6	12MX	6	16	6
57-H	2	8	0	12.0	6	0	0
57-L	3	3	6	12.0 De Luxe	6	10	6
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A.G.C. CIRCUITS

(Continued from Page 83)

sing frequency modulation for the ound signal, the problem of cross modu- ation in the receiver is not so serious s for systems with a.m. sound. Sharp ut-off pentodes (such as the EF80) are ormally used in the I.F. amplifier. Only wo A.G.C. potentials are required, one or the R.F. amplifier, with a fixed de- ay, and one for the I.F. amplifiers.

In order to obtain a wide range of utomatic control, without modulation istortion, it is important to ensure that s soon as the R.F. amplifier is controll- d, its rate of control is such that the naximum bias is applied simultaneously o the R.F. and I.F. amplifiers.

A resistance network designed to pro- ide the correct rates of control is shown n Fig. 7, which includes a diagram howing the distribution of the R.F. and .F. bias with input signal.

Any leakage current through the de- ay diode unbalances the control poten- ials and therefore a thermionic diode or a semiconductor diode with a very igh back resistance should be used. It s not good design practice to use the control grid of the cascode valve as a elay diode, since the maximum dissipa- ion ratings of the cascode valve might e exceeded.

The synchronising pulse separator as- sociated with the gate circuit may in- fluence the A.G.C. performance, and cer- ain features of its design require to be checked. The time constants in the grid circuits must be chosen to minimise the possibility of grid blocking.

The high-gain A.G.C. circuit will maintain the video signal constant for very wide changes in the input signal. It is, however, desirable to operate the syn- chronising pulse separator with a short grid base to ensure constant- amplitude separated synchronising pulses over a wide range of video-signal levels, such as may be obtained by normal adjust- ment (or maladjustment) of the contrast control.

CONDUCTION TIME

The pip or overshoot produced by dif- ferentiation of the trailing edge of the separated synchronising pulse will deter- mine the conduction time of the peak detector. The pip is only required to be sufficient in amplitude to prevent video signals near black level from causing the peak detector to conduct. Ad- justment of the differentiating capac- itor (C41, Fig. 6) during the initial design is best carried out by observing the peak-detector current on an oscillo- scope. A 1k ohm resistor connected in series with the anode of the peak detector forms a convenient monitoring point. The capacitance should be increased until the waveform is just clear of picture signals.

If the trailing edge of the separated synchronising pulse is very sharp the conduction time of the peak detector will be very short. The conduction time may be increased by slowing the trailing edge of the pulse by additional capacity at the anode of the synchronising pulse separator. In a practical circuit (Fig. 6) the conduction time was adjusted to about 2usec by the addition of C53 (47 pF).

The operation of the circuit does not depend critically on valve characteristics. The peak detector is in effect a cathode follower operating with a high cathode impedance, and the amplifier is pulsed into conduction to charge the coupling capacitor.

The peak currents of both valves are very low, the peak-detector being about 6mA and that of the amplifier about 1mA. Compensation for the variation in the grid bases of different valves and component tolerances is provided by the preset potentiometer RV51 (Fig. 6).

Changing the valve from an ECC82 to an ECC81, which approximately doubles the slope and halves the grid base, should not normally produce a noticeable effect.

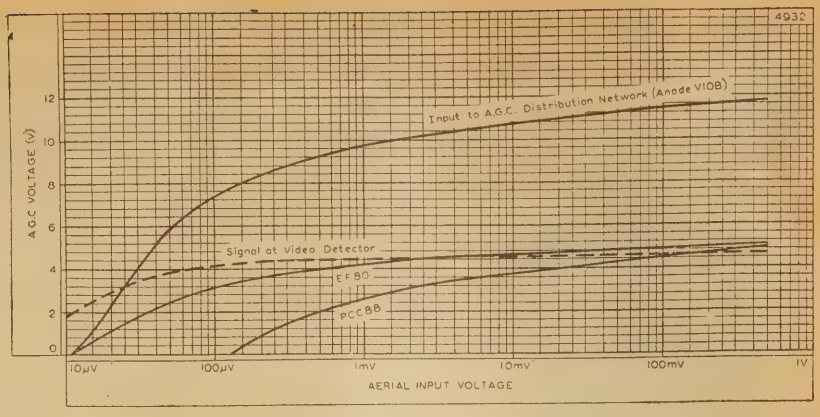

Fig. 8.—Receiver A.G.C. characteristic.

AC/DC CIRCUITS

In a D.C./A.C. receiver care must be used in siting the valve in the heater chain as any hum produced at the cath- ode modulates the A.G.C. potential. In practice, using an ECC82, the heater has been connected some 30 volts above earth without producing any perceptible hum effects.

The complete A.G.C. circuit used in an experimental 625-line C.C.I.R. receiver (CNU10) is shown in Fig. 6. The video signal is applied to the grid of the peak detector V10A by a potential divider consisting of two 100 k ohm resistors. R45 and R47. This ensures that the volt- age corresponding to black level at the gride of the peak detector is about 100 volts.

The negative synchronising pulses are A.C. coupled to the grid C54 and R46. The control bias is distributed to the R.F. and I.F. amplifiers by a resistive network as discussed earlier.

The screen-grid voltage of the video amplifier V9A is varied to provide man- ual adjustment of the contrast. This control varies the D.C. level of the sig- nal at the anode and therefore the black level. The A.G.C. circuit is sensitive to the black level of the signal and it there- fore produces a compensating change in the A.G.C. potential which provides the required change in the receiver gain. Be- cause the high gain of the A.G.C. cir- cuit, the black level at the picture tube is held substantially constant when the contrast is varied.

With a gated A.G.C. circuit using the tips of the synchronising pulses for re- ference information, adjustment of pic- ture contrast by varying the screengrid potential of the video amplifier may re- sult in overloading of the receiver when switching to a strong signal. The effect is caused by the variation of the grid base of the video amplifier with the con- trast-control setting, the tips of the syn- chronising pulses approaching cut-off and reducing the effective A.G.C. loop gain.

With an A.G.C. circuit using the black level for reference information, the tips of the synchronising pulses may ap- proach cut-off but the full A.G.C. loop gain is retained. An advantage of this method of contrast control is that the full grid base of the video amplifier is used with all settings of the contrast control.

The positive delay potential applied to the cathode of the pulse amplifier V10B sets the level at which the A.G.C. circuit operates. To allow for component toler- ances and spread in the valve character- istics, this voltage is preset by RV51.

The A.G.C. characteristic is shown in Fig. 8 and is obtained with a C.W. input corresponding to black level by free-run- ning the timebases at their correct fre- quency. It can be seen that the full A.G.C. voltage can be produced for a change of black level of about 1.0V at the video detector.

With a video-modulated R.F. signal ap- plied to the aerial sockets via a 75 ohm switched attenuator, about 55dB of at- tenuation can be switched in with no visible effect on the picture, except for an increase in noise level. (The maxi- mum output from the generator was limited, and the maximum A.G.C. poten- tial developed at the grid of the PCC88 was 3.8 volts.) The amplitude of the video signal at the amplifier anode was 50 volts peak-to-peak, and the change in its amplitude 2dB for a change of 55dB in the input signal.

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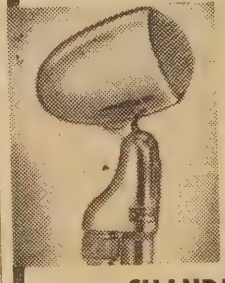
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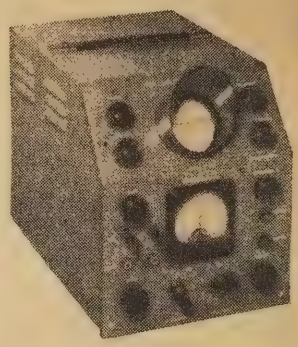

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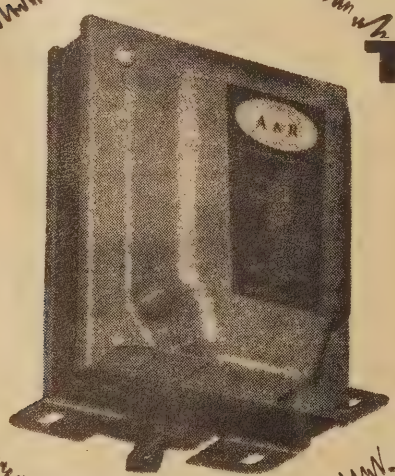

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THOSE LAZY VALVE CATHODES

Many puzzling types of circuit malfunction are caused by a subtle change inside the tube itself. This article, by arrangement with Radio and TV News, pays particular attention to "interface resistance" and its effects on various circuits.

AS newer and more complex circuits come into regular use, they bring with them new types of malfunctions to plague the electronic service technician The causes of many of these are elusive.

One such baffling condition, actually originating in the tube, may show up in either of two ways. Sometimes there is a loss in gain for the circuit involved which cannot be explained in terms of conventional defectiveness.

At other times it shows up as a strange overshoot at the leading edge of the pulse or other output signal from a stage whose origin is similarly mystifying.

In either case the malfunction may persist even after replacement of tubes or other parts that are suspected of being defective.

THE INTERFACE LAYER

A film of material, called the cathode interface layer, often develops in many vacuum-tube cathode structures. As Fig. 2 shows, this layer forms between the active emitting surface of the cathode and the base metal on which it is deposited.

Development of the interface compound is the result of chemical interaction between the emitting material itself and the base metal or some constituent of the base metal. Once formed the interface layer may exhibit several interesting properties.

For one thing, the compound may act as a semiconductor. The resistance of the layer may range from a few ohms to several hundred ohms. Unexpected circuit elements of this nature can obviously have appreciable influence on the tube's operation.

Nor is this all. Once the interface layer is present it can act as a dielectric, although a rather leaky one, between the emitting coating and the base metal. The two last-mentioned elements then become the electrodes of a capacitor.

The overall effect of the interface layer, then, is to introduce into the cathode circuit a parallel resistance-capacitance combination (Fig. 1). The time-constant of this RC network has been determined experimentally to lie in the approximate range between .2 and 2 microseconds. In individual cases it can be much longer.

EFFECT IS SERIOUS

In video amplifiers the effect of cathode interface resistance may well be serious. For a signal whose duration is very long as compared to the interface time-constant, the principal effect is a loss in gain, since the effective transconductance of the tube will be reduced.

An abrupt discontinuity applied to the tube grid will appear at the output similarly reduced in amplitude but accompanied by an overshoot at the leading edge of the pulse.

The symptom in the "diseased" cathode, often characteristic of video amplifier tubes, carries the popular designation "slump." The term is applied to a tube which behaves as though there were present in the cathode circuit a parallel resistance-capacitance combination with a time-constant up to several seconds.

NOT UNDERSTOOD

The response of such a tube to an input negative step or pulse of long duration is an output positive step which gradually slumps to a lower voltage level. The origin of the slump is not well understood. The effect is often a source of difficulty in the design of d.c. amplifiers for cathode-ray oscilloscopes.

When the "disease" shows up in equipment that has been operating for some time the real source is often not suspected. As a result, many needless hours are spent trying to correct faults believed to exist in associated circuitry.

Cathode interface resistance which develops in amplifier tubes may become much more serious in some applications than in others. For example, take the case of a binary divider. The flow of cathode current normally inhibits or deters the formation of interface resistance; but in binary one tube is normally cut off.

REDUCES CATHODE CURRENT

Under cut-off conditions, the deterring effect of cathode current is not present and the interface resistance layer may develop to much larger proportions. When a tube is operated at cut-off with a heated cathode for many hundreds of hours the interface resistance may become so great that, when the tube is finally turned on, cathode current may be reduced to half its normal value.

Hence when a binary has remained in one state for a long interval of time

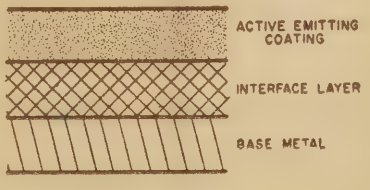

Fig. 2. As a result of chemical interaction between the cathode emitting material and the cathode base metal on which it is deposited, an intervening film, the interface layer, may develop.

it may well be impossible to induce a permanent transition. This particular condition or "disease" of the tube has been dubbed "sleeping sickness."

Interface resistance is present to some

Fig. 1. The interface layer has some resistance. Also, it acts as a dielectric between the emitting coating and the base metal. Thus it helps to form a capacitor that is in parallel with its own resistance — and RC network.

extent in all tubes with oxide-coated cathodes but is especially pronounced in tubes whose cathode base material contains large amounts of silicon. It increases with the length of time the cathode is heated.

It increases more in tubes operated at cut-off than in tubes drawing continuous plate current. It may appear in new tubes that have had prolonged shelf life. The end of the useful life of a tube may be the result of interface resistance rather than loss in cathode emission.

In recent years a series of special dual-triode vacuum tubes has been developed. The cathodes of these have been carefully treated to remove all impurities, such as silicon, which give rise to interface resistance.

MANY USES

At first these tubes were designed specifically for military computer service but they are available on the open market and are particularly useful in many video, pulse and digital circuits. Notable among these are the types 5963, 5965 and 5844.

The 5963 is similar to the 12AU7. The 5965 and 5844 incorporate other improvements, such as better balance to cut-off in the two sections and a high zero-bias plate current to permit the use of small plate-load resistors.

The change to use of special tube types is often the best-advised remedy in cases where the symptom occurs. In any event, careful tube selection should be considered before the tube is exonerated in circuits that are subject to the malfunctions noted here.

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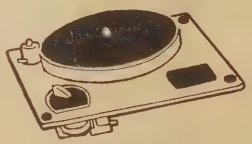

GARRARD 301 TRANSCRIPTION MOTOR

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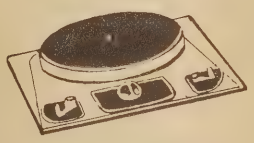

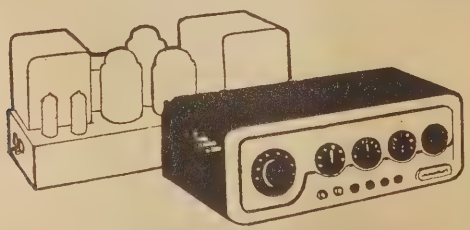

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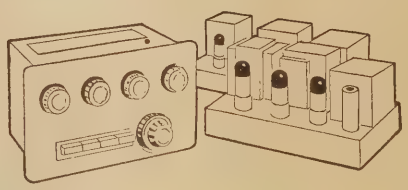

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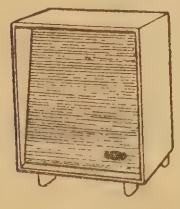

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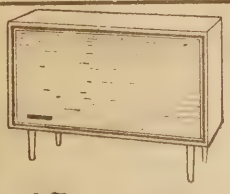

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Audiom 80

GOODMANS 325

Complete Three-unit High-Fidelity System. Overall frequency range: 30 c/s.-16,000 c/s. Bass Unit: Audiom 80 15" single-cone unit (30 c/s.-750 c/s.). Mid Range: Midax 400 pressure-driven horn unit (750 c/s.-5,000 c/s.). High-Frequency: Trebax pressure-driven horn unit (5,000 c/s.-16,000 c/s.). Capacity: 25 watts. Dimensions: 33" x 22" x 20½".

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Single-unit High-Fidelity Loudspeaker System. Frequency Range: 40 c/s.-15,000 c/s. Axiette speaker gives excellent angular coverage at all frequencies. Power output—6 watts, yet only 8 inches in diameter. Operating at normal room volume, the most critical listener would be unable to distinguish between Axiette and more expensive systems. Dimensions: 24" x 17" x 9¾". Ideal for Stereo.

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The 3S series incorporates all the basic features of incomparable Ferrograph design, specially developed for Stereo reproduction from tapes. The 3S functions as a normal monaural recorder but by the attachment of the Stere-ad unit, also as a stereophonic player.
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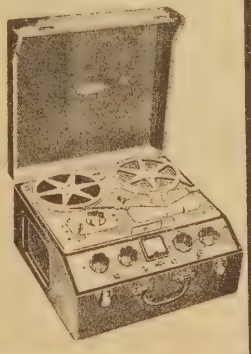

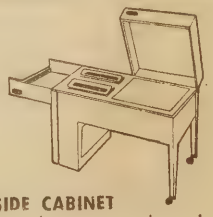

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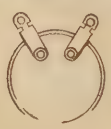

Terminating lugs are all heavily plated for ease of soldering and positive connection to the element is ensured by riveting. The riveted lugs, unlike pressure-contact types, will not loosen with soldering and the terminals may be bent for wiring to any convenient position without the control becoming noisy.

Resistance element consists of a metallised coating bonded to best-grade bakelite which is cured and seasoned at high temperatures. The result is a smooth, low-noise-level element, extremely hard and resistant to humidity and ageing effects. The flat strip principle enables the production of elements which conform more closely to the eight published curves than is possible with solid carbon tracks. By virtue of the physical size, the CS element therefore has a greater power dissipation with lower temperature rise than with other types.

Multiple finger contactor consists of five silver-plated phosphor-bronze springs which are independent of each other and have a "knee action" effect as they move over the element surface. The contact pressure of each spring is accurately adjusted to give correct pressure on the element for minimum noise level consistent with long life.

IRC CS controls are available in all standard values and tapers in plain, tapped, ganged and dual concentric combinations with or without DPST or SPST switches.

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TRADE REVIEWS AND RELEASES

LATEST TRANSISTOR TESTER IS VERSATILE AND EFFICIENT

The Levell Transistor Tester Type TM1 is manufactured by Levell Electronics, of Middlesex, England. Jacoby, Mitchell and Co., of 469 Kent Street, Sydney, are the local agents.

A quality instrument in a case only 9½in by 3½in by 3¼in. the TM1 is designed to give a dynamic check of transistor current gain for all small transistors and power transistors up to a maximum collector current of 0.5 A.

A 1,000 cps transistor oscillator operates from internal batteries and supplies a signal, the amplitude of which is monitored by the meter, to the base of the transistor under test. An internal battery also supplies the latter.

The alternating component of collector current is measured by switching the meter to the appropriate range giving a direct measurement of the current gain (beta), provided the input signal has been previously calibrated.

Collector current is continuously adjustable and may be read on 0 to 5, 0 to 50 and 0 to 500 mA scales. Amplitude of the 1,000 cps oscillator is little affected by changes in the collector current of the transistor under test making it possible to quickly check the beta over the range of Ic.

Values for Ico and Ico' may also be measured.

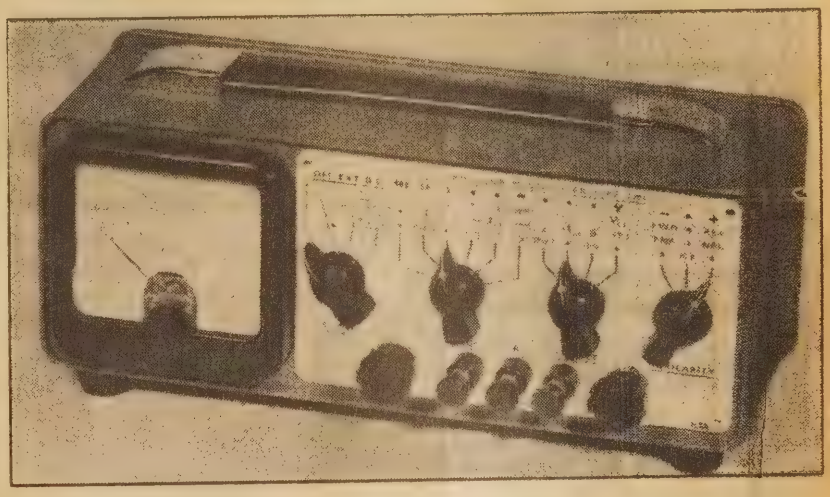
DYNAMIC READING

The instrument is well constructed and the manufacturer's tolerance of plus or minus 7 pc on beta readings over most of the range is probably conservative. The dynamic reading available at any point on the characteristic is a big advance on the simpler type of instrument which tests as a fixed, and often unknown, value of collector current.

Switching facilities permit measurements on both PNP and NPN transistors. Diodes can be tested for both forward and back resistances.

The metering circuits required to test transistors can be switched to the external terminals, making the TM1 a useful extra instrument when it is not being used for its primary purpose. Ranges available are DC mA. audio frequency mA and ohms. Output from the audio oscillator may also be used as a signal source, the amplitude being variable at the instrument.

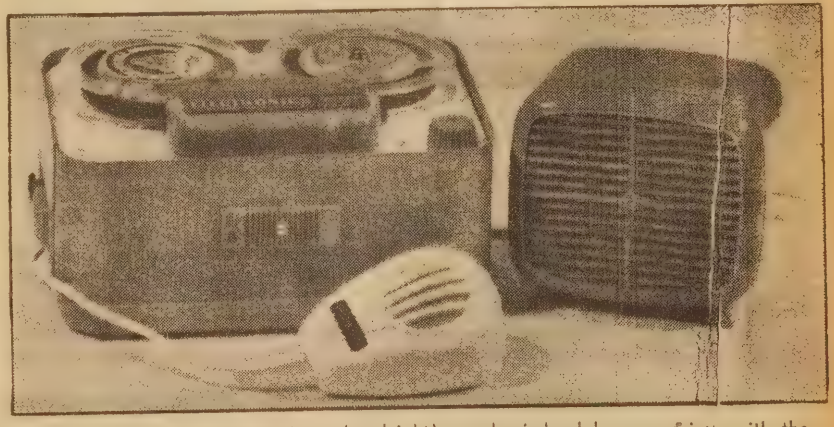
The price is approx. £68.



Though at first glance the panel of the Levell transistor tester looks complicated, it is not difficult to operate in practice.

BATTERY POWERED TAPE RECORDER

A miniature battery operated portable tape recorder has recently been released on the Australian market. It should be a boon to anyone who may have a special need for such a unit.



The size of the recorder and speaker (right) can be judged by comparison with the hand microphone (forefront) which is of normal dimensions.

Employing transistors throughout, it operates from four standard torch cells, each new set of batteries, according to the manufacturers, giving about 50 hours of service under typical conditions.

An adaptor unit provides alternative operation from the mains.

At 1-7/8 ins. per sec. a recording time of 1 hour is available on the twin track tape but the speed can be increased to a maximum of 7 ins. per sec.

Weight of the recorder, in a carrying case and complete with microphone and speaker, is 7lb.

The audio performance cannot compare with larger recorders but it is adequate for recording interviews, etc.

Retail price, less batteries, is £75.

Inquiries may be addressed to Electronics Aust. Pty. Ltd., 11-23 Hay Street, Perth, W.A.

NEW PHOTOTUBE BOOKLET

THE Amalgamated Wireless Valve Co. Pty. Ltd. have recently released a useful booklet dealing with Radiotron phototubes. It should be very useful to anyone whose work necessitates familiarity with these devices.

The first section of about 16 pages contains general information about phototubes, while the remaining 30 pages lists types, characteristics, socket connections, etc.

Copies are available from the above-mentioned company, 47 York Street, Sydney, for 3/ post free.

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CHASSIS AND TRANSFORMER KIT

for the **MULLARD 3/3 AMPLIFIER**

AMPLIFIER CHASSIS KIT

Contains:
1 Chassis.
1 Component Mounting Panel.
1 Escutcheon Plate — black lettering on satin silver.
1 packed set of Plated Screws, Nuts, Washers, Spacers, etc.
All Unit "A" metal work is protected fully by cadmium plating and passivation, and is finished in silver-grey hammertone enamel.

POWER TRANSFORMER

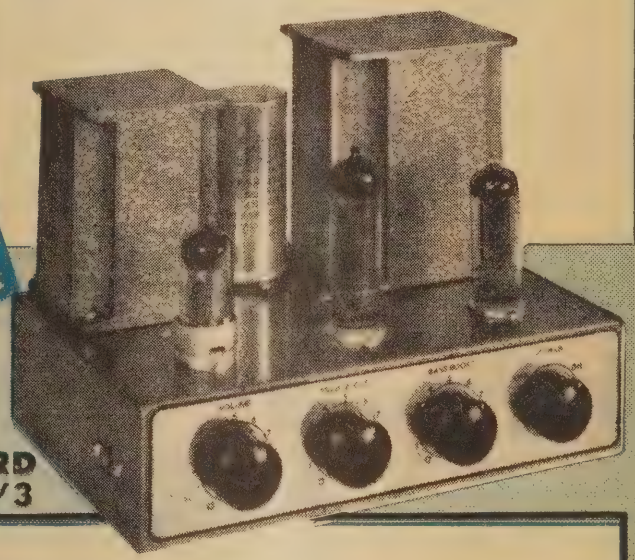
Primary: 230-240V at 50 c.p.s.
Secondary: 1: 300-300V at 60mA
2: 6.3V C.T. at 1A.
3: 6.3V at 1A.
Mounting: Diecast case, with colour-coded leads. Semi-hermetically sealed.
Finished in silver-grey hammertone enamel.
Complete terminating details are provided on a cardboard template. This forms a permanent colour code reference when cut out and fitted under chassis on mounting the transformer.

OUTPUT TRANSFORMER

Primary: 5,000 ohms.
Secondary: 2, 3.7, 8 and 15 ohms
(Value of R5 for 8 ohms V.C is 120 ohms).
(Value of R5 for 2 ohm V.C is 220 ohms).
Mounting: Diecast case, with colour-coded leads. Semi-hermetically sealed.
Finished in silver-grey hammertone enamel. Colour-code details on template as for Unit "B."
The performance figures of a "3/3" Amplifier using the above transformers are within those outlined in the Mullard leaflet.

GIVE YOUR 3/3 PROFESSIONAL PERFORMANCE AND APPEARANCE

At last—a basic constructor's Kit for the Mullard 3/3 Amplifier, with the same meticulous attention to detail as evidenced in the popular A. and R. Kits for the more complex "5/10" and "5/20." Here's a Kit that makes building the High Quality 3/3 so much easier—giving your final job a true professional finish. Assembly, layout and wiring details, together with performance and specifications are clearly covered in the Mullard 3/3 leaflet obtainable from A. and R. Distributors. All units can be purchased separately, if desired. Ask for full details NOW



OTHER BASIC KITS AVAILABLE!..

MULLARD 5/10 AMPLIFIER

A Kit already popular with home constructors!—it's the easy way to build a truly professional looking Mullard "5/10"—with considerable saving in time—and money. The Main Ampifier Chassis follows closely the layout as shown in the Mullard Booklet "High Quality Sound Reproduction." The pre-amplifier unit is redesigned, and both units allow the use of locally obtainable components.

MULLARD 20 Watt AMPLIFIER

For the Constructor aspiring to the Mullard 20 Watt, the A. and R. Foundation Kit is invaluable.
The Pre-Amplifier and Main Amplifier Units closely conform to the layout shown in the Mullard booklet, and both allow the use of locally obtainable components. Construction is so much simpler with the A. and R. Kit—and the finish is one of which you can be justly proud!

DISTRIBUTORS

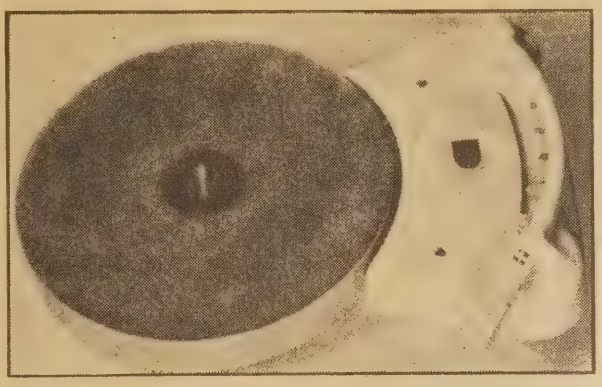
VIC.: J. H. Magrath and Co. P/L. Radio Parts. P/L., Homecrafts P/L., Warburton Franki Ltd. **SOUTH AUST.:** Gerard and Goodman Ltd., 196 Rundle St., Adelaide. **QLD.:** A. E. Harrold P/L., 123 Charlotte St., Brisbane, Chandler's P/L., Albert and Charlotte Sts., Brisbane, Trackson Bros. P/L., 157 Elizabeth St., Brisbane. **WESTERN AUST.:** A. J. Wyle P/L., 1064 Hay St., Perth. **TAS.:** Homecrafts P/L., 220 Elizabeth St., Hobart. **N.S.W.:** Factory Reps.: R. H. Cunningham. P/L., 16 Angas St., Meadowbank. Available from all Leading Sydney Distributors.

ELECTRONIC A&R EQUIPMENT

A & R ELECTRONIC EQUIPMENT CO. PTY. LTD.
378 ST. KILDA RD., MELBOURNE MX 1150

BATTERY-POWERED GRAMO MOTOR

An attractive new battery-powered gramophone motor is scheduled for release currently. It should find wide application in portable, transistorised record players.



DESIGNATED as type NG-012, it is Australian made and operates at four popular speeds—16, 33, 45 and 78 r.p.m. Speed selection is by a simple lever change, with a fifth position which lifts the idler wheel clear of the turntable.

The motor operates from a 6-volt battery, drawing about 45 milliamps, when set for 33 r.p.m. Speed is regulated by a governor, so that it is largely independent of battery voltage.

The makers quote a figure of 0.2 per cent of wow and flutter and quote the rumble as -35 db, which should be adequate for portable service.

The pickup is a crystal type with interchangeable heads for standard and microgrooves. It is extremely light in weight, proofed against moisture and capable of good electrical performance.

Though we have not as yet had opportunity to run extensive tests on the unit, it appears to be well made.

PRINTED BOARD FOR TRANSPORTA 7

READERS who may intend to build the "Transporta Seven" receiver will be pleased to know that a printed circuit board for the tuner section has been released by Messrs. Watkin Wynne of 21 Falcon Street, Crows Nest, N.S.W. Under the brand name of "Jabel," it should be available through trade supply houses.

The board follows closely on the original layout, with slight rearrangement to allow the AVC auxiliary diode to be above it. The finish is very good and printed leads are never less than 1/16in wide, so that danger of fracture and lifting is minimised.

The manufacturers propose to supply printed instructions along with the board to simplify wiring.

"DUST-BUG" RELEASED BY ACOS

THE Acos Dust-Bug Unit is a development of the original and now famous invention of Cecil Watts, who has spent years examining the effects of record wear and has produced some amazing micro-photographs to support his study.

Essentially the unit is composed of a nylon bristle brush, which trails in the grooves as the record rotates, and removes dirt and dust from them.

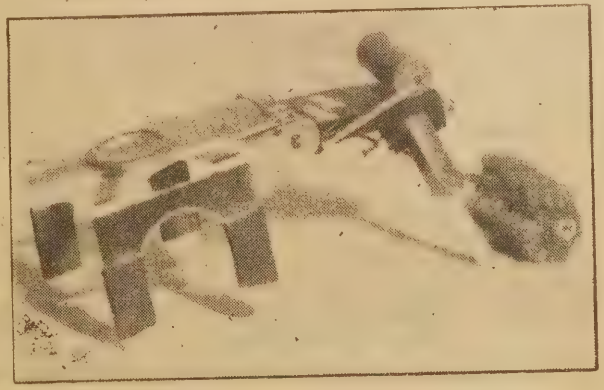
These are then picked up by the plush pad, which is treated with a special liquid to remove static charges from the disc.

The Acos version has a clip which allows it to be mounted on almost any type of pickup head so that it is automatically lowered in place when the record is played. It is particularly suitable for Acos pickups.

A spring mount loads the nylon brush so that the extra weight of the device is largely taken up by it.

Experiments with both types of Dust-Bug have demonstrated beyond doubt the surprising amount of dirt and grit which is removed from the disc, and the result can only be most beneficial both to reproduction and to record wear. A tube of special anti-static liquid is supplied with it.

The Acos Dust-Bug is distributed by the Australian agents, Amplion Pty. Ltd., and retails for £2/15/.



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MULTITESTERS

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NEW SHIPMENT JUST ARRIVED

HANSEN

THESE ARE HIGH QUALITY INSTRUMENTS SUITABLE FOR LABORATORY USE AS WELL AS RADIO AND TV SERVICING. ALL INSTRUMENTS ARE FULLY GUARANTEED.

MODEL 'TS' (Illustrated) is only 6¼in x 3 7/8in x 1¾in and weight is 1lb 2oz. Sensitivity 10,000 O.P.V. Ranges:— **DC Volts.** 0-7; 35; 140; 350; 700. **AC Volts.** 0-7; 35; 140; 350; 700. **High Voltage** AC/DC 17,500 with HV Probe. **Resistance** 0-50,000 ohms 0-5 meg. (internal battery). **DC Current.** 0-100 uA. 0-1.4; 140 mA. **AC Current.** 0-200 uA. **Capacity.** 50 pF to 50 uF. **Inductance.** 0.1 to 1000H. **D.B.** from minus 15 to plus 59. Supplied complete with test leads. RF Diode probe. EHT probe and multiplyers for both C and L.

£14/3/6

MODEL "SC." This is the smallest multipurpose meter produced with so many ranges. Size only 5½in x 3¼in x 1in. Weight 12½oz. Sensitivity 6000 ohms per volt. Ranges:— **DC Volts** 0-6; 30; 120; 300; 600. **AC Volts** 0-6; 30; 120; 600. **Resistance** 0-20,000 ohms. 0-2 megs. (Internal battery.) 0-200 megs. With external voltage source. **DC Current.** 0-300uA; 0-12; 300 mA. **Capacitance.** 0-2 uF. **Inductance. 0-1000 H. DB** minus 15 to plus 58. Calibrated "S" scale. Supplied complete with test leads.

£8/-/-

KEW MULTIMETER

SHIPMENT ARRIVING THIS MONTH.

This is the lowest priced test instrument that we have ever offered. It is not a toy, but an accurate multimeter. Size 4in x 2¼in x 1½in. Weight 8oz. Ranges:— **AC/DC Volts** 0-15; 150; 1000. **DC Current** 0-150 mA. **Resistance** 0-100,000 ohms. Sensitivity 1000 ohms per volt. Complete with test leads.

£3/15/-

Fragile post 5/- extra per meter.

PRICE'S RADIO

5-6 ANGEL PLACE SYDNEY

Let's Buy An Argument

You have to be quick in this magazine game, or you get left way behind. Nor is it the old hoary heads who necessarily present the greatest challenge. The current generation of schoolboys seem to be equipped with ready appreciation of matters electronic.

by Neville Williams

THE other day, for example, I became aware that a couple of lads near me in the train were discussing the merits and demerits of a radio circuit. During the course of the conversation, one of them mentioned quite casually that he had just finished off a 5-inch oscilloscope.

Who paid for it or what it was wanted for wasn't clear but there you are. At his age, I was excited enough over a mere crystal set!

ANOTHER SCHOOLBOY

Then you may have noticed last month that one of the correspondents buying into the argument about anti-matter was a 15-year-old schoolboy. It's fashionable to talk, these days, about empty-headed bodgies but letters like that are proof enough that empty-headedness isn't a universal characteristic of the rising generation.

And lastly, there's the letter opposite, over which you may care to pause and read. It is only a simple matter but it further illustrates the point I have just made.

Back in the December issue, we attempted to solve an argument through the "Answer Tom" columns, put to us by a group of country readers. They submitted the circuit shown by G.R. and wanted to know the potential difference between the points A and B.

Staff member Wes Yashin, whose lot it was to answer the question, treated it as purely a confusion of thought on the part of the contenders. He pointed out that, with no DC circuit between points A and B, as shown, there could be no current flow. The 0.2amp figure therefore had no basis in fact.

This amount of current would flow only when points A and B were shorted across, in which case there would be no potential differences between them and no grounds for argument.

When checking the proofs of this article, another staff member, Maurice Findlay, protested strongly and loudly. He maintained that the condition could be satisfied by introducing an external potential difference between the terminal A and B and proceeded, further, to show that the arrowhead supported this idea.

Asked to settle the matter I suggested firmly but kindly to Mr Findlay that he not be entirely "Uncle Willy" which, I understand, is double talk for "silly." I suggested that Mr. Yashin had the right idea; that the contenders were simply confused in their ideas of current and voltage and were not likely to have marked the arrowhead with any special intent; that no one would want to take the problem as far as he suggested we should.

ROUGH JUSTICE?

In short and in cliche, he was making a mountain out of a molehill

And who do you think, some weeks later, picked G.R.'s letter out of the correspondence basket?

Mr. Findlay, of course!

And what do you think he wrote on it before passing it to yours truly?

Just this: "At least one of our readers has a clear appreciation of the problem."

Okay, Mr. Findlay. Okay, Master Rousseau. I know when the odds are against me.

On another subject altogether, some observations I made during the month gave me reason to ponder synchronising problems in television receivers from a different angle.

As will be evident from an article elsewhere in the issue, the observations were directed primarily at establishing a reason for the faint white "spook" line which is sometimes apparent across the screen of a television receiver. It would appear that it is due, in many cases, to an overshoot from the trailing edge of the synch. pulse, which renders the scanning spot visible part way along its return trace.

EFFECT ON SYNCH?

While observing this overshoot effect, I could also see evidence of overshoot on the leading edge of the blanking pulse and the leading edge of the synch, pulse. I couldn't help speculating as to whether these overshoot effects would modify the behaviour of the synch. separator stage.

For example, when the video lines finish with white video information, the succeeding blanking pulse presents a long steep front, which can produce overshoot approaching the height of the following synch. pulse.

It is not unreasonable to expect that

this could cause the synch. separator to conduct, causing the spike to be reproduced in the plate circuit, with a higher relative energy level, due to clipping. As such, it may be sufficient to influence the line oscillator.

With lines ending in black, there would be only a very small step to the front porch, possibly very little overshoot and the synch. separator output would revert to normal.

Most of us have seen television receivers in which the horizontal deflection has shown some dependance on picture content. Vertical lines have wavered or wrinkled in accordance with movement at the extreme right hand edge of the screen.

ANOTHER FACTOR?

This can be due to many things, singly or in concert but I'm wondering whether overshoot effects, confusing the start of the synch. pulse proper, may not also be a contributing factor.

There's another aspect to this matter. The standing bias developed by a synch. separator tube is a function of the amplitude and shape of the peak positive-going pulses fed to its grid. The plate output signal is a conglomerate of the bias, the input signal and the valve's overall clipping action.

The normal situation is a rectangular grid input signal and a similarly rectangular plate output pulse. But is it not reasonable to expect that the output from some separators at least will show a reaction to an overshoot spike at the grid extending beyond the regular synch. pulse by possibly its own height?

An interesting point is that, in the receiver under examination, overshoot spikes were not in evidence on TCN Channel 9, they were noticeable on ATN Channel 7 and very prominent on ABN Channel 2.

Now how many times have you heard remarks about some stations having "better synchronising" than others? Many times, I wager.

In my own experience, in Sydney, I have often heard TCN rated as having "good synch." and ABN as "bad synch." However, I've tended to discredit such remarks, believing that most such reports had to do with partial overload by the lower frequency and usually more powerful signal.

MAY VARY WITH CHANNEL

But what if a certain proportion of receivers are prone to serious overshoot? What if the degree varies with the natural variation in the pass-band between the respective channels? What if a difference in rise time between different transmitters aggravates or otherwise this overshoot? Could not these things explain reports about stations with so-called "good synch." and "bad synch."?

And finally, what about the disposition of test patterns on the screen of a receiver.

Many remarks have been made about stations not positioning their test cards uniformly with respect to the raster. We've said as much ourselves. We've been as frustrated as anybody when, after carefully centring a pattern on one channel, we've turned to another and found it noticeably off centre.

There may be technical reasons at the transmitter for some of the discrepancy and there may be an element of carelessness on occasions, on the part of the operating personnel. But I don't think the story necessarily ends there.

One can imagine factors in the receiver which may influence the position of the pattern on the screen. Among them, I'm now wondering about the influence of distorted synch. pulses.

While on the subject of television, a reader from Pennant Hills, N.S.W., takes me to task for countenancing and apparonly encouraging the use of terms like "negative going" in our technical articles. I quote:

"An expression your technical boys seem to have adopted is "negative going voltage" or "positive going voltage." Where is it going, anyway? Why not just negative voltage or a rising negative voltage?"

While I am grateful to A.D.F. for his comment, I can still look him in the face without feeling guilty about the particular expressions. In fact, I rather like them.

One of the major requirements in writing for any newspaper or magazine is to express thoughts clearly and concisely. Within the limits of commonsense, the story and presentation is more important than strict rules of grammar.

SHORT PARAGRAPHS

That is why paragraphs are often only one sentence long, dictated not by the subject matter but by the desire to avoid heavy blocks of type, which are rather forbidding to the eye. Sentences sometimes begin with a conjunction and occasional infinitives are split, because the writer feels that the smoothest thought flow is achieved thereby.

Or it may be done for emphasis.

One might suggest that the language is thereby made to serve the writer and the reader rather than the reverse.

In the case of a technical magazine, these same considerations apply, with the additional complication that unfamiliar terms and phrases have to be included in the text. They can be a very real hazard.

CAN BE HINDRANCE

When describing a process or evolving an explanation, the line of thought can be completely broken by excess verbiage or by having to interpolate paragraphs not in the direct line of reasoning. Rather than do this, I would much rather coin a graphic phrase to get the thought across—and run the risk of being censored by a linguistic purist.

That's why I tolerate and even like the term "negative-going."

I doubt that A.D.F.'s quip about "where it is going anyway" is really justified. To be consistent, he'd need to have the same objection to phrases like "Outward Bound" and "Westward Ho," neither of which make the ultimate destination very clear!

The term "negative going" leaves the reader in no doubt about what is meant. It clearly indicates an excursion of voltage or signal and the direction of that excursion.

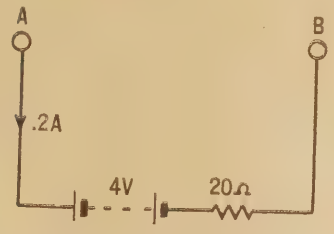
Used alone, as A.D.F. suggests, the word "voltage" conveys no sense of movement and carries no intuitive distinction to the mind of the reader between signal or steady-state voltages. If anything, it tends to favour the latter.

Consider, for example, the signal at the output of a television video detector. In some contexts the important point may be to stress the polarity of the signal. It would be incorrect simply to refer to the synch. pulses as negative and the picture information as positive be-

A YOUNG READER HAS HIS SAY

Dear Sir,

I have a comment to make regarding your answer to a correspondent in the "Answer Tom" column in the December '58 issue. The answer is that concerning potential difference across point A B in the circuit given.



On examination, one notices that the current (conventional) is in a direction opposite to that of the current which would be set up by the 4-volt cell. This suggests an emf acting between A and B so as to drive current anti-clockwise around the circuit.

If this emf is V volts, then the algebraic sum of emf's in the direction of the current is (V – 4) volt. Hence, by Ohm's law:—

$$V - 4 = .2 \times 20$$

therefore $V = 8$

Thus an emf of 8 volts must act between points A and B, giving the solution to the problem as under—

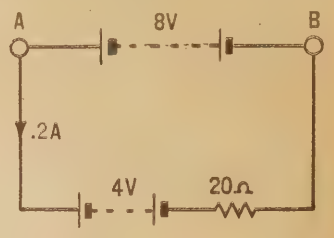
The question of measurement is now self-evident, methods being

(1) High resistance voltmeter.

(2) V.T.V.M.

(3) Potentiometer circuit.

It is perhaps noteworthy that 8 volts was one of the suggested solutions. I would like to see mention



made of this point in the "Argument" column since the question and its solution should be of general interest.

I wish, also, to express my appreciation of the high standard of the magazine as a whole. Wishing you the compliments of the season.

Yours faithfully,

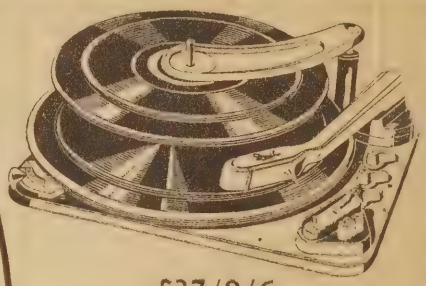
(Master) G. H. Rousseau.

Dual

AUTOMATIC PRECISION-BUILT CHANGERS and PLAYERS

1005 — CHANGER

Fully Automatic with many superb features to guarantee faithful reproduction and reliability of operation. Automatic needle selection—built-in scratch filter—pause switch to control changing time cycle—roller glide selection of record size—tone arm lock and many other carefully designed functions.
Fitted with the oustanding CDS3 cartridge and DN2 twin sapphire needle assembly.



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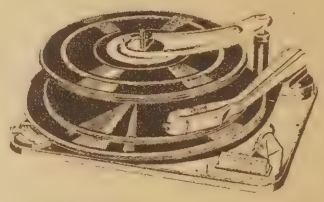
1004S — STEREO-CHANGER

Specially designed to meet the high technical standards required for the efficient reproduction of Stereophonic Records. Featuring a new control the "Stereo Key" both channels can be connected in parallel allowing conventional records to be played through Stereo equipment with a new realism. Operation is by Push Button control incorporating "Start" "Stop" and "Repeat" functions. Needle selection is by simple trigger control in the pickup head. Fitted with KS2 Stereo Head and DN3 Needle Assembly.



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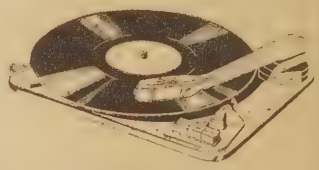
1004 — T12 AUTO-PLAYER

A completely automatic player with Push Button Control—automatic roller glide indexing—pickup muting—drive roller release—auto-cutoff—pickup arm lock and many other features. The gentle action and safety features of this model virtually eliminate all danger of damage to records caused by careless or hurried handling. Fitted with CDS3 Cartridge and DN2 Needle Assembly



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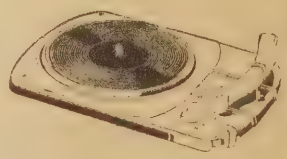
295 PLAYER

Fitted with automatic cut-off this model is particularly suitable for building-in where space is limited or for use in portable units. Fitted with the CDS2B cartridge and DN2 Needle assembly the same high quality of the larger DUAL models is retained.



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DN24 (Diamond L.P. Sapphire Std.) £11/-/-
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cause, in point of fact, the entire output of the detector must of necessity be negative with respect to reference earth.

On the other hand, the terms negative-going synch. and positive-going picture information clearly imply the direction of signal excursion without necessarily bringing earth potential into it.

Much the same is true at the plate of the video amplifier, where the entire signal is positive with respect to earth. Here it may be necessary to communicate the fact that increasing white involves an excursion in a less-positive direction, which is really a negative signal as far as the picture tube is concerned, except that the presence of D.C. stops it from ever becoming really negative . . . Ah Hec!

See where you get to?

SYNCH. SEPARATOR

And, finally, you feed this same signal through a capacitor to the grid of a synch. separator stage. With any other valve, you could breathe freely and simply state that the signal swings the grid positive on synch. pulses and negative on picture information. It would be roughly correct.

But the grid in a separator stage draws current and generates a negative bias, making it necessary to explain that positive signal voltage peaks produce a standing negative bias. However, the valve doesn't just conduct on positive signal peaks, using positive in the absolute sense. It conducts also on that segment of the signal which lies between zero and cut-off bias.

In other words, the valve conducts during "positive" signal peaks, portion of which are actually "negative."

Faced with this kind of situation, is it any wonder that some technical writers, including the author, resort to different terminology.

As for the suggestion of "a rising negative voltage," I'm afraid it leaves me completely cold. One's intuitive senses immediately begin to speculate whether the negative voltage is rising in the sense of "increasing" or "rising toward reference earth," which means just the reverse.

DOESN'T LIKE WORD

A.D.R. also takes me to task for using the term "circuitry," rather than just plain "circuit." Admittedly, I can't make as strong a case for the term as for those just discussed. I have used it more or less automatically as have others, because it seems more collective in sense than just plain "circuit."

Thus when one is attributing an effect to the overall design of components, their interconnection and possibly the physical wiring of a particular section of an equipment, it is insufficient to use the word circuit. It is identified far too much with the mere schematic.

"Circuitry" is a new word, even if a coined one, but it does have a collective sense. Thus, to attribute a certain effect to the "circuitry" of the line output stage means something wider than the "circuit" of the line output stage.

Anyhow, so much for phrases and words.

The foregoing was written on Wednesday, February 25, and, having completed it, I pushed the typewriter aside and went off to the Sydney Division meeting of the Institution of Radio Engineers, Australia. At this meeting, Mr John Van Der Goot gave a lecture on television synchronising circuits.

I had the welcome opportunity in the discussion period of raising the matters mentioned earlier in this article and of hearing additional ideas and opinions prior to publication.

Here are some of the points which emerged.

(1) If overshoot is to occur, due to misshapen bandpass characteristics, it will most likely happen on Channel 2. This is simply because the natural passband of the tuner may diminish in proportion to the lower signal frequency.

(2) The bandpass characteristics of the overall signal input path can be affected by connection of a badly matched aerial system. Thus, overshoot conditions may exist when a TV set is receiving an actual station, which cannot be reproduced by the connection of test instruments through a dummy cable.

(3) There do appear to be differences between television signals, as transmitted, the differences varying from time to time as the transmitters are variously readjusted and serviced. What is more, overshoot spikes would appear to be actually radiated on occasions, ABN being cited by one member as a recent offender.

(4) Whatever the cause or causes, the possible existence of overshoot spikes at the receiver detector is not in question. However, despite their prominence in terms of amplitude, the duration is so short that it seems doubtful whether they could ever represent sufficient energy to disturb normal operation of the receiver.

So much for spikes. Two other points emerged which might well have provoked a loud guffaw in other circumstances. However, since it was then purely a private matter, I had to be content with a suppressed chuckle.

The lecturer explained the polarity of signals at various points in a circuit in terms of "positive-going" and "negative-going."

While I was still chuckling over this he attributed certain undesirable effects to the overall "circuitry."

Sorry, A.D.F., but I think you would have smiled with me.

REPORT ON TELEVISION—1915

Forwarded to us by a reader, the following paragraphs are extracted from "Wireless World" for June, 1915. Written by M. J. Martin, they sum up the attitude to "seeing by wireless" 44 years ago.

Although many attempts have been made during recent years to solve the fascinating problem of "television" there has been up to the present no system that can claim to be in any way practicable.

Experiments have been made in which fair results have been obtained, but, as far as the writer is aware, these have never passed beyond the laboratory stage.

There have been several systems devised that are workable, but, to employ them for practical purposes, is out of the question on account of the enormous expense entailed.

One of the simplest and at the same time one of the oldest systems employs at the transmitting station a screen composed of a mosaic of small selenium cells. These cells are all connected separately at the receiving station with a battery and small electric lamps, the lamps being arranged in similar order to the mosaic of selenium cells.

If a simple picture in monotone be thrown upon the mosaic of selenium cells, the resistance of those cells that are under the influence of the light parts of the picture is reduced and insufficient current flows through the line to light the corresponding lamp at the receiving station.

A picture, constant as long as the cells are under the influence of the original picture, is thus obtained on the receiving screen.

According to some calculations made by Mr Shelford Bidwell, the cost of receiving a picture 2in x 2in with a grain as fine as an ordinary newspaper illustration, over a distance of 100 miles would be one and a quarter million pounds and necessitate the employment of at least 40,000 selenium cells.

Many modifications of this method have been devised, the most recent employing only three line wires and a common earth; but, except for the system briefly described above, all television systems depend for their action upon what is known as the "persistence" of vision, the whole process of building up the secondary picture occupying a space of time not more than one-tenth of a second —the duration of the persistence of vision.

There is no doubt that in the near future we may have some practical system of television to work over ordinary conductors; the idea of wireless television is, from a really practical point of view, absurdly improbable.

The fact that wireless photography and wireless telephony are experimentally accomplished facts in no way proves that wireless television is feasible. The principles involved are entirely different.

In telephony the vibrations which affect the ear, causing different sounds, consist of a number of impulses which impinge in very rapid succession on practically one spot on the telephone diaphragm; and while in television we also require a large number of impulses delivered in very rapid succession, or simultaneously, the impulses must also be arranged in proper sequence in order to reproduce correctly the transmitted picture.

To construct wireless apparatus capable of transmitting and receiving 40,000 signals in one-tenth of a second and arrange them in their correct order would surely tax to the utmost the powers of our cleverest inventors and prove the limit of even human ingenuity.

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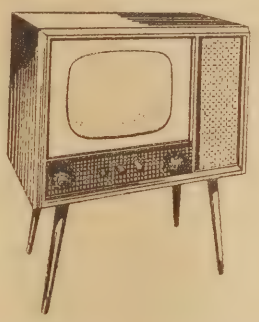

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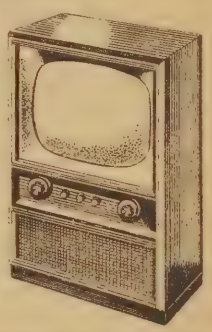

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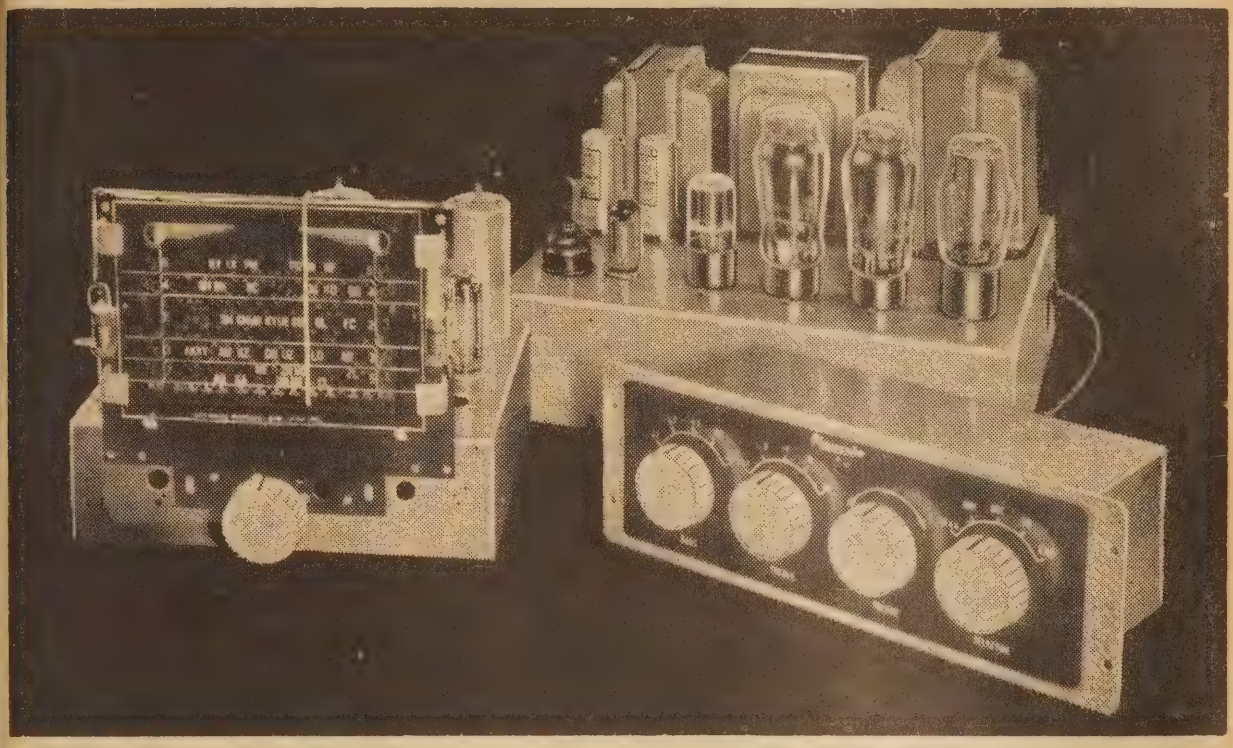

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OFF THE RECORD — NEWS & REVIEWS

Quite a jump has been made in the progress of stereo during the last couple of months. It isn't very long since I was complaining bitterly about the lack of records and equipment, and the slowness with which the industry was taking to stereo.

by John Moyle

BUT today there are a number of stereo equipments available in the shops, and quite a few records with the promise of more to be added steadily each month.

Interest in the subject is also being reflected in our mail bag, and by the requests I have been receiving to talk about and demonstrate stereo to various groups and societies.

By the end of this month I will have given six such talks, and will have to call a halt if most of my spare time is not to be taken up preparing for them.

One of the most interesting and pleasurable was a second evening spent with the Audio Society here in Sydney. As on the first occasion, the hall was packed to the doors, and the interest shown was considerable.

A COURAGEOUS MAN!

Incidentally experience with demonstrations in public halls, even on a humble scale, increases still further my admiration for the courage of G. A. Briggs in mounting his real life comparisons with recorded sound in both America and England.

With stereo the matter is even more difficult, and I can only say that audiences to date have been very understanding as well as appreciative.

It must be rather frustrating to make a trip to the city to hear stereo in action, only to be forced into a seat at the side of a hall where very little real stereo can be heard.

But it is an interesting fact that, even in such circumstances, most are able to appreciate an improvement in sound over the standard L.P's.

As with an ordinary room, there are concrete advantages in the fact that the sounds are coming from different parts of the room, even if the listener isn't able to pin point their actual source.

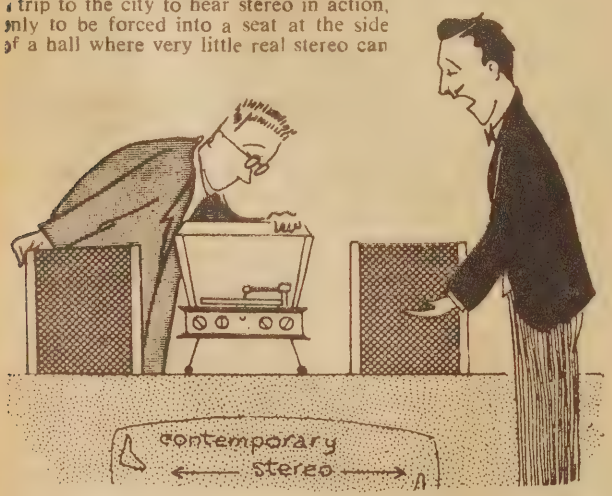
As a matter of fact there are quite a few indirect advantages which stereo brings with it, as against those more obvious and upon which stereo primarily depends.

Most people now realise that the foundation of stereo records is the ability to separate two sounds recorded in the same groove.

If the system is capable of almost complete separation of two such channels, it can also blend them in almost any degree to the ears of a listener sitting within a prescribed area. Sounds can be heard to either side, directly in the centre, and so on, according to the relationship of the information carried by each channel.

But when one has gone past the fascinating business of hearing these things happen, and it is no longer a novelty for a clarinet to come from one speaker while a drum plays from the other, it is the combination of sounds to provide a wide sense of spread and depth which is really the most rewarding.

To listen to a good orchestra for two or three hours in stereo, and then to play similar music on a single channel, is to realise once and for all that there is no retreat from stereo once you have heard it.



"Frankly, sir, we've done better than 45/45—this set is nearer to 50/50 . ." (Hi-Fi News)

I have been particularly conscious of this fact this month, for I received several stereo discs which were first sent to me as standard L.P.s, and most of which sounded quite good that way.

Incidentally they have confirmed my suspicions, voiced some time ago, that many records we have been playing over the last 18 months were really L.P versions of ultimate stereo issues.

I felt this was so because of the marked difference in recording techniques which were demonstrated by some, although not all, of these discs.

They were playing down many of the things which had characterised the best L.P.s in their heyday such as close and carefully mixed miking, pared down and even variable reverberation times, strongly featured bass, slashingly recorded highs, instruments individually picked out for special emphasis.

The records now had a more authentic concert hall air about them. Mikes rarely hugged any source of sound, drums were more remote and harder in their sound, reverberation was reassessed and so on.

In other words, just the kind of thing one would expect to sound best when spread out all over the end of the room.

And with the difference in recording set-ups for stereo have gone many of the problems which follow closely controlled acoustics in the attempt to resemble reality by varying elementary things such as presence, and dynamic range.

Stereo has taken the only real step towards true realism in recording since recording was first invented.

It has very greatly increased the scope of musical sounds which, when recorded, will represent a very fair estimate of the sound as originally heard.

This is due to the fact that stereo introduces a number of new conceptions of listening which previously we could not achieve, and is therefore far more than merely an extension of old techniques blended into two channels.

One of the greatest difficulties with single channels is to obtain the effect of separation between instruments which, particularly in certain sections of their ranges, are not easy to distinguish one from the other.

STEREO REWARDS

In the past, subtle placement of microphones could achieve differences in presence which one hoped would be appreciated by the listener, and help the selective process of his hearing to do the rest.

With stereo, we can naturally space these instruments apart right up to complete separation if we so desire, so that not only can the ears more easily separate them, but intermodulation effects can be greatly reduced, and a definition reached which the single channel reproduction just couldn't achieve.

Some, if not the most, important results of stereo, lie in matters of this kind, and, I think, explain why stereo sounds so much better in many ways which, in the first instance, we didn't expect.

Now I want to say a word about the small stereogram described elsewhere in this issue.

The design and construction of this equipment was concluded some time before these lines were written, and the descriptive article was put together at the same time.

One of the purposes of that design is to illustrate that simplicity can be

achieved without sacrificing the essential things I feel it must have if it is to be good and honest stereo.

The elementary requirements for good results are simple and they are clear. They ask for two similar amplifier channels feeding two similar speakers spaced apart at least as far as the listener expects to seat himself from them. They call for matched and ganged controls so that any change in one channel automatically takes place in the other, and they ask further that the sound quality from each channel shall be substantially the same. This presupposes a method of balancing the channels for gain to make up for differences of a few db, which are enough to make one lead the other, particularly in the middle ranges.

Any compromises with those simple requirements must be considered as degrading the stereo effect which, although it will still probably be better than the old single channel, nevertheless will be a compromise.

SEPARATION IMPORTANT

A case in point are the single cabinet stereo radiograms which undoubtedly will be made and sold here as elsewhere.

It is obvious that separation by only a few feet cannot give the same results as separation by 10 or 12 feet.

Often our convenience will demand that closer separation must be accepted if we are to have stereo at all. Not all rooms are shaped and furnished for the ideal treatment.

I only hope that the public will be encouraged to realise this fact, and that the significance of the word stereo won't be downgraded by rosy advertising claims as has happened in the case of "hi-fi."

Readers of our magazine are not likely to be confused for we have done our best to present the subject objectively on all possible occasions.

But as observers overseas have had occasion to point out, there is a tendency to label the humblest stereo efforts with the same advantages as can only be obtained by those which conform to the basic essentials.

Provided speakers are used capable of the appropriate degree of separation, our simple radiogram must not be discounted just because it is simple.

I have been using it ever since it was built, and can vouch for the fact that it really sounds wonderful.

Its five valves will easily give far more volume than a similar number has done in the past, much more than the ordinary radiogram user will want. Its quality is at least as good if not better, it is virtually humless, and very easy to get into operation. I don't believe the owner of such a set should be satisfied with anything less because he has no need to.

SIMPLE BUT GOOD

Only the most critical are likely to want something better, and this they have always done and always will. In this regard, there is no real difference in requirements between stereo and single channel equipment.

The new design has surprised all who have heard it, and changed the opinions of many who, to date, haven't been quite convinced that good stereo isn't necessarily complicated nor highly priced.

Some correspondents have asked whether it matters if the two channels are not correctly set up as to which is the left hand and which the right.

Except for those occasions when the subject matter refers specifically to the positioning of each channel, I don't think it does, although it isn't hard to get them the right way round, either by listening or by arranging things that way.

There is a convention in defining the channels, but it is doubtful whether to date it has always been followed. These conventions are given herewith for reference.

Most pickups have three output connections to the cartridges, and these are staggered so that left and right are easily identified. Not much effort is needed to carry the connection through to the speakers.

NO SET METHODS

After all, the exact positioning of instruments of the orchestra, for instance, is subject to considerable variation according to circumstances, which include the ideas of both conductor and recording engineers, and their main objective has been the blending of the sounds.

It is far more important that the speakers themselves should be phased correctly to avoid the hole in the middle which, after some experience in listening, isn't hard to pick, particularly when playing standard L.P.s.

Most commercial radiograms will undoubtedly be correctly connected during manufacture, and the home builder shouldn't have much trouble in following suit.

Right and left channels can be correctly set by varying either pickup or speaker connections, preferably the latter, but speaker phasing can only be accomplished by changing over the connections to one speaker only.

Talking of speakers I wonder how many readers have been faced with the situation in which, having previously picked the best corner in the room for their speaker system, they now find that for best stereo they must move it away?

There is a spot in my own room which has been very good over the years, particularly for the development of bass which never sounds as well from any other position.

But it is far from being a convenient place to stand one of the stereo speakers ,which are much better in a different part of the room.

It could be quite a problem for those who have triangular baffles, particularly of the type which use the walls to complete the rear sides of the enclosure.

Undoubtedly stereo places a great deal more emphasis on room acoustics if we are seeking the best possible results. But, after all, what can we expect as the demands we make on reproducing standards continue to multiply?

Reports from overseas indicate a great deal of experiment and research to produce more compact speakers and enclosures which will still give good frequency range.

Apart from columns and other special designs, the enclosed box used with very low resonance cones seems to be occupying the attention of many. I think we can expect a good deal of activity

Undoubtedly stereo places a great deal from small packages.

STEREO DISC STANDARDS

★ In stereo discs the two channels shall be right-angle modulations of a single groove.

★ In the 45/45 system of stereo disc recording, the two axes of displacement modulation are inclined 45 degrees to the disc surface.

★ In 45/45 stereo discs, the right-hand information, as viewed by the listener, shall appear as modulation of the outer sidewall of the groove.

★ In 45/45 stereo discs, equal in-phase signals in the two channels shall result in lateral modulation of the groove.

★ Lateral modulation of the stereo disc shall produce equal in-phase acoustical signals at the speakers.

★ The 45/45 system is recommended as a standard for stereo discs.

It is further recommended that:

★ The desirable tip radius for reproduction stereo discs be 0.5 mil.

★ Included angle of groove be 90 degrees.

★ The bottom radius of the groove of the finished record be 0.2 mil maximum.

These are the findings of the Engineering Committee of the RIAA as reported in their Bulletin E3.

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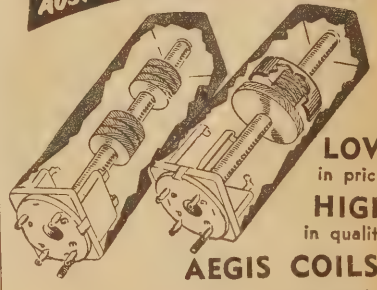

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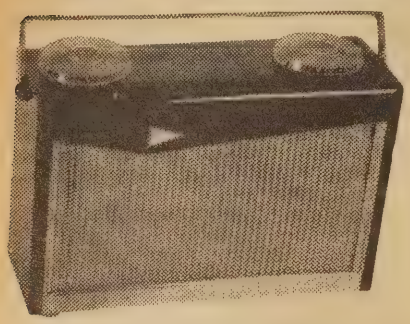

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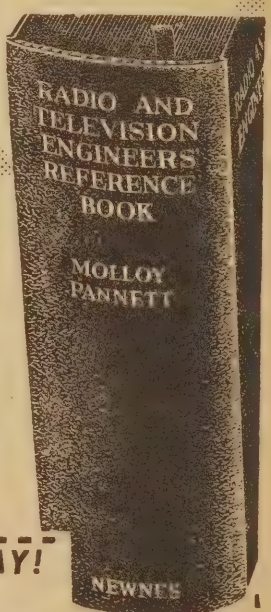

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SELECTIONS FROM MADAME BUTTERFLY. — Renata Tebaldi, Nell Rankin, Giuseppe Campora, Giovanni Inghilleri, with the St. Cecilia Chorus and Orchestra, Rome, conducted by Alberto Erede. Decca CEP 503.

SELECTIONS FROM LA BOHEME.—Renata Tebaldi, Hilde Gueden, Giacinto Prandelli, Giovanni Inghilleri, with the St. Cecilia Chorus and Orchestra, Rome, conducted by Alberto Erede Decca CEP 512.

Both records contain excerpts from full-length operas by Decca, and both have strong claims to being the best in their fields

Tebaldi's beautiful voice and glorious singing is the magic which illuminates them both She is easily the best of the Mimis and Butterflys, two roles often sung by famous voices lacking in the essential youthfulness and freshness without which neither is convincing

I particularly liked the Boheme, which, although ancient in LP years, has much delicate orchestral playing and is vocally top class Mimi's Farewell is particularly fine

Both are heartily recommended

★ ★ ★

RIMSKY KORSAKOV—Scheherazade Symphonic Suite. Played by the Vienna Festival Symphony Orchestra conducted by Max Schoenherr. World Record ST11.

This is quite a good performance, but spoiled by excessive surface noise on my copy which both crackled and rumbled.

It is a big, resonant affair with deep and powerful bass and full body of tone

It is quite straightforward. All the well-known instrumental bits are appropriately handled It hurries where it should and is sentimental likewise.

But there isn't very much imagination or subtlety about it—not t be compared with Beecham's disc of some months ago

A case in point is the end of the Kalendar Prince This is a veritable welter of contrasts in colour and dynamics, but most of the opportunities are unrealised.

Assuming mine was a noisy copy, the record sounds well enough, but musically is in the second rank among some particularly good competitors

★ ★ ★

LA BELLE FRANCE — Eleven popular arrangements from the Classics played by Carmen Dragon and the Capitol Symphony Orchestra conducted by Carmen Dragon. Capitol Stereo SP8427.

Already released as a standard L.P. this disc gains immeasurably in stereo.

Carmen Dragon's popular arrangements are melodious and romantic but they do not stray very far from the primary intentions of the music, nor do they introduce any effects or ideas which would outrage even the musical pedant

In most cases they are imaginative and I found them always interesting

Sur le Pont d'Avignon is a case in point. It is quite short, as is appropriate to its simplicity and charm, both of which could have suffered without this respect for the music and tact in handling it.

La Marseillaise is blood tingling, but in an American way rather than French By contrast, Debussy's Premiere Arabesque delightfully preserves the delicate atmosphere of the original and I thought it one of the best.

The stereo effect emphasises spread and depth rather than separation In fact there are no gimmicks at all, apart from some obvious placements such as the trumpets in La Marseillaise and one or two odd spots.

Compared with the L.P. version, good though this was, stereo achieves a size and realism which lifts it completely into a new class.

The sound is typical of Capitol's clear, clean quality The bass seems a bit light, but the balance is very good indeed and in stereo that is the thing which really counts

The performance, too, is good, and all this adds up to a fine disc.

It is one everyone will like and clearly illustrates some of the more rewarding points about stereo

★ ★ ★

DANCES FROM OPERAS — by Weber, Strauss, Tchaikowsky, Smetana and Weinberger. Played by the Bamberg Symphony Orchestra conducted by Heinrich Hollreiser Vox APL-10,590.

The recording as such is clean, although in the loud passages there is some confusion of sound, possibly due to reverberation and miking.

The music has been well selected. It has about the same weight and degree of interest — all the items sit sociably together.

Performances are good, but there isn't much to tax orchestral resources unduly. They are in general bright to hear with good vitality and life

The surface passes.

★ ★ ★

STARLIGHT CHORALE—Famous Choruses from Opera by the Roger Wagner Chorale and the Hollywood Bowl Symphony Orchestra conducted by Roger Wagner. Capitol Stereo SP-8390.

This is another Capitol which is vastly improved in its stereo form.

This is due largely to the fact that a choir of any size has never been easy to make convincing when contracted to the dimensions of a single channel, no matter how carefully it is handled.

In reverse, the miking poses initial problems of good balance and even of clean sound.

All these have been handled very well here, not forgetting the complications introduced by the orchestra which inevitably goes with choral work of this type, and whose inclusion makes things a good deal harder.

Having the equivalent LP allows me to make a most illuminating comparison, and a perfectly fair one.

The two channels widen and deepen the sound, and at the same time give a subtle placement of voices so that the LP appears particularly flat.

For many it will be the stereo which saves this disc, for many of the items are not otherwise inspired

Or it may be that the "great operatic choruses" have been great for so long

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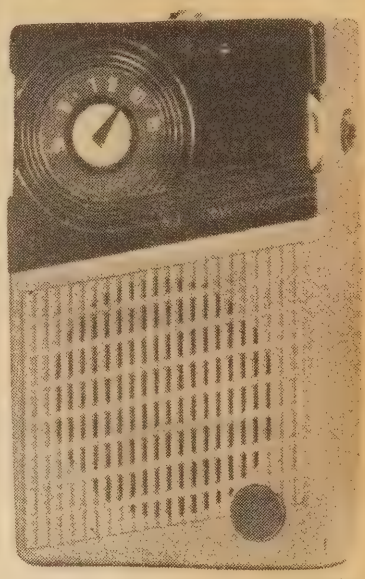

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and so often that many feel they know sufficient about them.

It is a record which does illustrate how valuable stereo will be in the field of opera, for instance, where the full array of orchestra, voices, and choruses are so often anti-climaxial on discs.

It should put new life into such things, and the prospect might truly be considered as exciting.

★ ★ ★

SCHUMANN—Piano Concerto in A minor. Played by Wilhelm Kempff and the London Symphony Orchestra conducted by Josef Krips Decca LW 5337.

It's rather difficult to describe this performance in a word, mainly because it doesn't fit neatly into any set style.

Kempff has always had a tendency to do sudden things to dynamics and tempo, some of them odd, at least to my ears.

He is at it again, particularly in the first movement which is so often played fairly steadily, smoothly and romantically.

Kempff, on the other hand, gives the impression that he has thought it all out, not merely to be different, but in search of illumination he has hoped to find in the music.

In many instances this impression is undoubtedly correct, but some of his doings seem to have so little place in a logical pattern that I fear they are in fact capricious, to use an adjective often applied to his work.

His general idea of the concerto is restrained and frequently gentle, but he is able to present the music with great power and decision when necessary, as he does, in fact, in both first and last movements.

But never at any time do either pianist or orchestra really get wound up.

And without considerable animation, the last movement isn't the brightest thing in the world.

The recording is extremely pleasant to hear, with good balance. Its articulation is clear and dynamic range more than adequate.

The graceful picture made of the last movement is due mainly to fine playing and sensitive recording.

Just where you will place this personalised version will largely be a matter of taste. I don't know whether I could pick an outstanding local release, so even on these grounds this disc should hold considerable appeal.

★ ★ ★

PROKOFIEFF—Peter and the Wolf Opus 67. Played by the Philharmonia of Hamburg, directed by Hans-Jurgen Walter with Richard Attenborough as narrator. World Record S10.

The drama of this musical story isn't as high as in most other recordings, but there have been so many varied versions that there is probably room for another.

Richard Attenborough steers a mid-course between the original and effective style of Richard Hale and the suspect silliness of the Walt Disney version.

He guides us through the sequence of events as one who gives assistance to solve a rather knotty and involved problem, rather than a story-teller who should be building our interest in a fairy tale.

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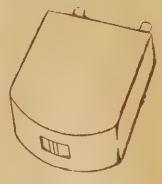

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This impression is shared by the orchestra which, for all its careful and often meticulous reading of the score, doesn't achieve the complete continuity—and a smooth one at that—of the Boston Pops.

Acoustically the orchestra is fairly closely miked in a hall showing pronounced reverberation. Its lively sound is marred for the critical ear by some fluffiness on the extreme tops—cymbals for instance—although the hard percussion has fared quite well except for a kind of suppressed echo at its first appearance.

And at times the surface isn't as quiet as it should be.

I'd class it as a safe performance in a low key, not particularly exciting, but with many good points all the same.

★ ★ ★

STRAUSS — Emperor Waltz, Tales From the Vienna Woods. VON SUPPE—Poet and Peasant Overture, Morning, Noon and Night. Played by the Vienna State Opera Orchestra, conducted by Hans Swarowsky. World Record TT13.

This is an amiable record, not only because the music is pleasant and amiable also, but because it has a promenade atmosphere to it, as though all concerned were having a good time in a not too serious mood.

The sound is remote, particularly in contrast with the Coronets which I had just been hearing, and there is a good deal of reverberation of the concert hall type. It also covers up much of the individual effort, and blunts the edge of many instruments.

The cello solo in Morning, Noon and Night is a sufferer in this respect. Better microphone placement might have done a good deal more justice to it.

The performances are lively and keen, but technically I could not rate it particularly high.

★ ★ ★

STRAVINSKY—Le Sacre Printemps. Played by the New York Philharmonic Orchestra, conducted by Leonard Bernstein. Coronet KLC2680.

Firstly I should say that this is the most vivid recording I have ever heard from Coronet, and that is saying something.

The music is savage, pagan stuff, and it must be played that way to extract its considerable impact.

Without appropriate sound and the opportunity to appreciate the contrasts and concords of orchestration, most of the composer's intentions would be lost. This is essentially a work in which the interweave of sound carries its chief import, and we must at all costs be able to appreciate the full range and colour of instruments to understand what is being done.

Bernstein revels in this kind of thing, not only as a musician, but as one who appreciates the significance of recorded sound.

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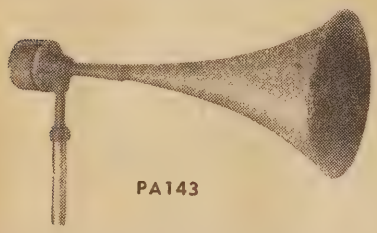

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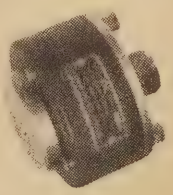

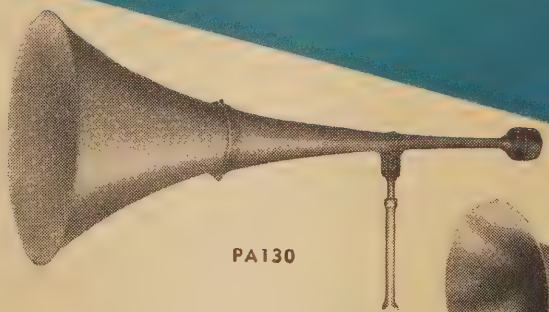

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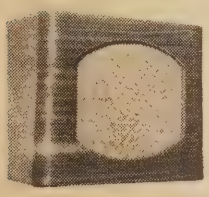

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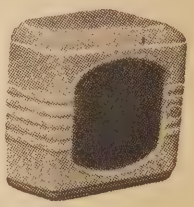

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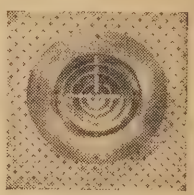

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miking has been used, which emphasises separate instruments rather than the orchestra as a whole, and the result is almost terrifying in its power and proximity.

It would be idle to detail the many sonic features which will strike you, and stimulate your eardrums almost to exhaustion.

Particularly good is the precision of the brass, whose sound tears the air with enormous effect, and the heavy bass, which registers not only its sheer weight, but in its upper harmonics projects a quality like a hot breath.

The point I make is that the brilliance of sound has been exploited, not for a hi-fi holiday, but because it is used as an essential to project the conductor's vital and almost brutal concept of tension and power.

I find that in the foregoing I have also made my comment on the music as such. Others have tempered their outlook with a mixture of mystery and a veil of distance and time, but not Bernstein.

He is bent on firing it right at you in all its latent force and fury, and one must agree that he has succeeded in this to a remarkable degree.

The quietness of the surface, the clarity of the sound, and the great scope of frequency and dynamic range impels me to register admiration for such a standard.

Whether you feel that something has been sacrificed to gain such nerve shattering end is a matter for you and Stravinsky.

I am certain, however, that no matter what your ideas on this may be, you will not hear it unmoved.

Let me mop my brow before I continue.

★ ★ ★

MOZART—Violin Concerto No. 3 in G Major, K2;6. HAYDN — Violin Concerto No. 1 in C Major. Played by Isaac Stern and the Columbia Chamber Orchestra. Coronet KLC676.

The recording shows an exceptional degree of clarity and forwardness which makes heavy demands on both players and equipment.

On each side the orchestra is a small one, and the miking ensures that we hear all there is to hear.

It has, therefore, an intimacy and presence which are quite unusual.

As might be expected, it has picked out the edge of the strings, which is probably faithful and authentic, but which I can well imagine would sound rather too close for comfort if your pickup and/or speaker is at all peaky.

On this point it is surprising how much of this edge is really present when listening to strings at close quarters, and which is mostly lost on audiences which generally hear them from much greater distances than does the microphone.

But if these players were really in your room, undoubtedly you would hear them.

From a technical point of view, I can only applaud the accuracy with which the upper harmonics have been caught, even if you might find them easier to take when toned down.

The effect is not so noticeable in the Haydn, in which the miking is not as close. On the whole, I thought it sounded better for it.

Stern dominates the scene at all times with his strong and sure performances. He is always a forceful player and I personally prefer less tension in such music. I don't mean that he lacks flexibility or delicacy of touch — on the contrary, his control and sensitivity are extremely good, although he can play like a man possessed when he likes.

But this is definitely modern and rather pressurised playing which dazzles as much as it endears, and rather too demanding for relaxed listening.

At the same time, one could hardly imagine more lifelike recording for better or worse.

But it is only fair to applaud some really beautiful effects on both sides, despite the deadly precision which is most marked, and the deadness of the studio which makes it all the more obvious.

The surface is absolutely silent on my copy — when the music stops you just can't hear a sound.

For sheer faithfulness, Coronet have never done better. The cutting amplitude is extremely high, and I hope it is not contributing to the sharpness of the tone.

★ ★ ★

BEETHOVEN—Symphony No. 6 in F Major, Opus 68 — Pastoral. Played by the Columbia Symphony Orchestra, conducted by Bruno Walter. Coronet KLC673.

The richness of the orchestra is immediately apparent as this symphony opens.

It sounds big and broad as it should, firmly supported by full bass, and the authentic tones of the "mighty voice" flow through the room.

You won't find any surprises, either, in the application of Walter's touch, amazingly alive and resilient for a man well past his eightieth birthday.

His control of the players, his obvious attention to detail, his occupation with the significance of every phrase, would be remarkable in any conductor, and doubly so for one who could be pardoned now for showing a less keen ear and sense of proportion.

But when you listen to the beautifully played second movement, noticing how every instrument is delineated and balanced, how so many of them are lifted out to highlight an effect but never to dominate unduly, and how surely the gracious nobility of the music is exposed, you will agree that this is Beethoven of the first Walter.

The recording is first-class. Its tone is massive, and its bass perhaps a shade too prominent. But I like it that way, and it is not at all difficult to reproduce.

There is a faint tape hiss, but otherwise the noise level is negligible.

This is one of the very best Pastorals, one which will wear well for its all-round quality.

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SHORT-WAVE NOTES BY ART CUSHEN

FLASHES FROM EVERYWHERE

FRENCH WEST AFRICA station, which has been identifying as Radio Mauritania, has been under examination by many listeners, particularly in the United States, as to its exact location. It now would appear to be a broadcast from Radio Senegal in Dakar, which is especially for listeners in Mauritania.

The station has been using the same frequencies as those of Dakar. The station uses 4,950, 9,562, and 7,210 Kc., up to 8.30 a.m. Programs then are carried only on 4,950 Kc., to sign off at 9.30 a.m., while on occasions a short news broadcast in English has been released at 8.30 a.m.

The station identifies as "Ici Radio Mauratania" when it leaves the air. Mauritius is reported to have a new transmitter of increased power soon to be put into service from Forrest Side. The station has been heard at present on occasions on 15,020 Kc. and has English news at 2.0 p.m.

NIGER in West Africa, with its programs on 5020 Kc. broadcasts 3.30 to 7 a.m. Programs are mainly in French and an experimental broadcast is being made from 4.30 to 5.30 p.m. at present, while a further transmission for noon reception in Niger, 10 p.m. our time, is also planned.

NAIROBI in Kenya with the African Broadcasting Service, has its transmissions now scheduled on 4934 Kc. The station operates 1.30 to 2.30 p.m. and midnight to 4.30 a.m. A further broadcast from 8 to 9 p.m. is carried on 7172 Kc.

ALGERIA with broadcasts from Algiers, has these transmissions now over four shortwave frequencies. French is broadcast on 11835 Kc. from 3.30 to 5.30 p.m., 8 to 11 p.m. and 2 to 8.15 a.m. Arabic is on 9685 Kc., 3.30 to 5.15 p.m., 8 p.m. to 8 a.m.

A network for the Kabyl listeners is released on 6145 Kc. from 3.30 to 4.30 p.m. and 9 p.m. to 11 p.m. and further from 2 to 5.30 a.m. The relay of the Paris programs in Arabic on 7115 Kc. is from 4.30 to 9 a.m.

SWITZERLAND is the home of a new missionary station, and the Emetteur Prodostant International, is soon to be broadcasting in 22 languages including English. The station is expected to be in operation from 4.30 p.m. to 10 a.m. each day.

CAMEROON now has a second transmission from Doula, and this is on the air from 5.45 to 7.30 p.m., 11.15 to 12.30 a.m., 5 to 9 a.m. News in French includes broadcasts at 6.30 and 7.05 a.m. The station uses 6115 Kc. with 1000 watts.

BURMA broadcasting in the Burma Broadcasting Service from Rangoon now uses 4795 Kc. This frequency is on the air from 10 p.m. to 1 a.m. A period of English is released from 11.30 p.m. to 11.45 p.m.

BRAZZAVILLE transmissions on Radio A.E.F. are now carried 3 to 6.45 p.m. on 4795, 5970, 9545 Kc., all using 4000 watts. Further frequencies are 3 to 4.55 p.m. on 9620 Kc. with 50 Kw., and 15440 Kc., with 1500 watts from 4 a.m. to 6.45 a.m.

FRENCH SOMALILAND station Radio Djibouti, is on the air on 4780 Kc. from 1.30 to 3 p.m. and again 1 to 6 a.m., with 4000 watts. The frequency of 6000 Kc. is in use from 6.30 to 8 p.m. also with 4000w.

PHILIPPINE station DZB6 broadcasting from Manila, on 4945 Kc. uses the slogan "The Voice of Education." The station is on the air on weekdays from 7.50 to 9 p.m., and on Sunday, 11 a.m. to 1 p.m. The power of 300 watts is to be increased as is the schedule of the station.

TROMSO station of the Norwegian Broadcasting Service has relays on the home service from Oslo on 9550 Kc. The frequency is in use 3.40 to 6 p.m., and while the use of 17755 Kc. is made from 8.20 to 11 p.m. and 1.30 to 8 a.m.

SAO TOME which has broadcasts by the Radio Club of Sao Tome on CR5SC, which uses 4807 Kc. and the power 1000w. The power may be increased to 5000w and the station is on the air daily from 5 to 7 a.m. Verification is by a folding card which shows pictures of the scenes on Sao Tome.

LOURENCO MARQUES, the site of the transmitters of the Radio Club of Mozambique, has been noted with transmissions on 11760 Kc. The broadcast of a commercial nature is beamed to South Africa and opens at 1.30 p.m. The station is reported to have changed its opening signal and now plays a series of songs before the transmission gets under way at 1.30 p.m.

OMDURMAN, with transmissions from Khartoum, has been heard on two new frequencies when opening transmissions at 2.15 p.m. The station is stronger on 9615 Kc. but the same program in Arabic is also carried on 11857 Kc. and this frequency has also been heard by a North American listener.

HIGH POWER FOR SOLOMON ISLANDS

The new high power which is being used by the Solomon Island Broadcasting Service has resulted in wider reception.

THE full details of the new transmissions from Honiara were received in a letter from the Solomon Island Broadcasting Service, which has the mailing address of Box 115, P.O., Honiara.

The new high power on short-wave was put into service with VQO2 on 5,960 Kc., commencing January 5th. The station operates VQO on 1,030 Kc., with 660 watts, using a Marconi transmitter, and on 5,960 Kc. with 5,000 watts. This new transmitter is of A.W.A. construction. The short-wave aerial is an eight-element vertical incidence array, designed to concentrate the signal within the area of the Protectorate. The signal is put out at a very high angle, but from reports received it appears that considerable radiation is being received beyond the main target area.

The new schedule of the station includes the relay of B.B.C. news at 7.15 p.m. each evening. The station is on the air each night Monday to Friday from 6.0 to 8.30 p.m., and on Saturday and Sunday the station is on the air from 7.0 to 8.30 p.m. The station opens with a program schedule read together with commercial announcement. Local news is also carried by the station at 7.30 p.m., reports R. F. Corbett, Broadcasting Officer.

Broadcasts from Nigeria

TRANSMISSIONS from one of the best received West African countries, Nigeria, will again be heard this winter, and the present broadcasting times of these stations are listed below:—

Lagos broadcasts on 4,995 Kc. with 20 Kw., 3.0 p.m. (Sun. 4.0 p.m.) to 6.0 p.m., 1.30 a.m. to 8.0 a.m., and 9.0 a.m. on Sunday.

Lagos, on 9.655 Kc. with 20 Kw. operates 7.30 p.m. (Sunday from 4.30 p.m.) to 2.45 a.m. Weekdays; the transmission is also on this frequency 4.30 p.m. to 6.0 p.m.

Kaduna (North Regional) on 3,326 Kc. with 7,500 watts. 3.0 p.m. to 5.0 p.m. and 2.0 a.m to 8.0 a.m. On 6,175 Kc., 7,500 watts, 9.0 p.m to 1.45 a.m.

Ibadan (West Regional), 3,205 Kc., 5Kw., 3.0 p.m. to 5.0 p.m., and 4.0 to 8.0 a.m. On 7.285 Kc., 5 Kw., 7.30 p.m. to 1.45 a.m.

Emugu (East Regional), on 3,965 Kc., 2,500 watts, 3.0 p.m. to 6.0 p.m., 2.30 to 8.0 a.m. On 6.145 Kc., 2,500 watts, 7.30 p.m. to 2.0 a.m.

SURINAM transmissions from Paramaribo are now using the new frequency of 15,227 Kc., from 7.30 a.m. to 12.30 p.m. This frequency replaces 15,405 Kc. The 5.0 a.m. to 12.30 p.m. transmission of the Home Service is still carried on the frequency of 4.850 Kc.

REPUBLIQUE de Guinee. Radiodiffusion National Conokry, on 4,910 and 7.125 Kc. broadcasts 5.0 to 6.0 p.m., 10.15 to 11.30 p.m., and 4.30 to 7.30 a.m. The station carries local language programs 4.30 to 5.45. All other programs are in French.

News from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern Standard time.

Schedule from Tokyo

THE present transmission schedule from Radio Jajan, Tokyo, has undergone some frequency changes due to seasonal transmission conditions. The stations are at present operating on the following schedule:—

3.30 to 4.30 p.m., to Western and North America on 17,855 and 15,325 Kc.

4.30 to 6.30 p.m., to Europe on 21,620 and 17,855 Kc.

5.0 to 6.0 p.m. to Hawaii on 17,825 and 15,235 Kc.

7.0 to 8.0 p.m., to Australia and New Zealand on 15,235 and 11,940 Kc.

7.0 to 8.0 p.m., to South America on 11,705 and 9,525 Kc.

8.30 to 10.30 p.m., to China on 11,705 and 9,525 Kc.

9.30 to 10.30 p.m., to Philippines and Indonesia. 15,325. 17,855 Kc.

11.0 p.m. to 1.0 a.m., to South-east Asia on 15,235 and 11,705 Kc.

11.0 p.m. to midnight, to East Asia on 11,800 Kc.

1.30 to 2.30 a.m., to South Asia on 15,325 and 11,780 Kc.

3.30 to 4.30 a.m., to Middle East on 15,325 and 11,705 Kc.

9.0 a.m. to 10.0 a.m. to Eastern North America on 21,620 and 17,855 Kc.

Kabul on 4042Kc,

BROADCASTS from Afghanistan have been in the past few weeks reported on several frequencies, with test transmissions, and the latest channel to be used is 4042 Kc.

The station, which is operated by the Afghan Broadcasting Service, has the address of Telecommunications Division, Ministry of Communications, Kabul. The station is on the air on 660 Kc. 12.30 to 1.30 p.m., 10.0 p.m. to 4.0 a.m., but the latter transmission, it is understood, is only on short-wave

In the past the transmissions have been on 18.430, 6,005, and 4,945 Kc.

The station carries a broadcast in English from 2.40 to 3.0 a.m., with a news broadcast at 2.45 a.m. A Cyprus report states the last tests on 4,945 Kc. were concluded in February, and then the announced frequency of 4040 Kc., which has been measured as 4,042 Kc., was put into service.

SABC on 9720Kc

RECEPTION of the Commercial service or the Springbok Radio, as it is called, from Johannesburg, has been made on 9,720 Kc. in the mornings. The station was strongly received at 2.15 a.m. with a commercial program, and at 2.30 a.m. gave details on the frequencies in operation. The announcement was made that transmission on 9,720 Kc. was then closing and would be resumed in the 60-metre band in a few moments. Listeners were advised to tune to the 41-metre band for a continuation of the present program.

The station left the air and the frequency was then covered by jamming, showing that the strength of this signal had overridden this severe interference. SABC was heard on this frequency also last winter, when they were logged with the commercial programs at 4.30 p.m.

MANILA, with broadcasts on the new 50-Kw transmitters of the Far East Broadcasting company, has increased its transmissions basically aimed at the Far East. The latest schedule is on DZF2 11920 Kc. 11 p.m. to midnight, midnight to 12.30 a.m. in Tamil, 12.30 a.m. to 1 a.m. in Hindu, and 1 a.m. to 2 a.m. in English. A further transmission beamed north commences at 2 a.m. in English to 2.30 a.m., 2.30 a.m. to 3 a.m. in Russian, 6 a.m. to 8.30 a.m. in Japanese, and 8.30 a.m. to 9.30 a.m. in Mandarin. Broadcasts on DZF3 using 15380 Kc is on the air 9.30 a.m to 10.30 a.m. with a program in English.

ALL INDIA RADIO has opened two new channels in the 60-metre band, according to a listener in Cyprus. The station, with programs originating from Delhi, has been heard on 5058 and 4822 Kc. The stations were in parallel with the broadcasts from Delhi from 1 a.m. to sign off at 3.30 a.m.

MOZAMBIQUE signals, which are frequently heard in this area during the winter, have been switched to different frequencies, according to a Cyprus report. The English program is now heard on 4840 Kc as well as on 3230 Kc. A broadcast in Portuguese is now on 4925 Kc and this one is carried also on 3250 Kc, both these transmissions being logged after dawn.

TIBET broadcasts on the Lhasa station are being received on 9489 Kc from 11.30 p.m. to sign off at midnight. The station suffers severe interference from Moscow on 9480 Kc. The station is reported to have the complete schedule of 10.30 to 11 a.m., 3.30 to 5 p.m., and 9 p.m. to midnight.

HRN, with broadcasts from Honduras capital Teguicigalpa, and with the slogan "La Voz de Honduras," has moved from 5950 and is now on 5873 Kc. Radio Montserrat is now using 5938 Kc.

SOMALI transmitter of British Somaliland, which has broadcasts from Hargeisa, has altered frequency from 4765 to 4790 Kc. The station is in chain with 9667 Kc. Broadcasts are from 11.30 p.m. to 3.30 a.m. The broadcasts in Somali are from 11.30 p.m. to 1.30 a.m. and 2.30 a.m. to 3.30 a.m., while the English program is released from 1.30 to 2.30 a.m.

OUBANGI-CHARI, a new African country to the short-wave field, has broadcasts from Bangui and is using 5025 Kc with 250 watts. The station is only in experimental stages and will soon increase its power to 4000 watts.

AMATEUR BANDS WITH BILL MOORE

DANNY WEIL SHIPWRECKED FOR THE THIRD TIME

DX-peditions which journey to outlandish countries are now commonplace and each month brings forward more excursions. One of the best known of these providers of unusual prefixes was unfortunately again shipwrecked.

DANNY WEIL VP2VB, etc., world traveller and well-known supplier of new prefixes to the DX gang, unfortunately lost his boat for the third time. It was named the Yasme II.

In February it broke up on rocks near Union Island, north of Grenada in the Windward Islands.

It was Danny's third attempt to sail around the world. Australian amateurs will remember his first attempt. After sailing nearly 40,000 miles in October, 1956, he lost the Yasme on a reef north of New Guinea.

Australian amateurs were active in his rescue.

The second attempt was short lived; his boat blew up during refuelling in North Wales.

According to Press reports Danny's radio equipment was salvaged during his latest misfortune and he will set up a fixed station on Grenada.

He will make a world-wide appeal to radio amateurs for help to continue his voyage and supply further new countries for DX enthusiasts.

DX FEVER ON 50 Mc.

According to reports with the 50 Mc band used so often for DX operating, procedures have developed some of the unwanted characteristics of those heard on the 14 and 21 Mc bands.

Some of the pile-ups common on the latter bands have appeared on 50 Mc when rare DX is about. It is only natural with the band open for such long periods that more and more amateurs are attracted down there.

The higher pressure DX techniques developed as the band population increased.

There was a time when the VHF gang were a group apart as communication at these frequencies was being developed. Most of the occupants were technically inclined and there was more scope for such activity in this portion of the spectrum.

Operational courtesy was marked and, if anything unusual was heard, time, frequency and direction was quickly passed around.

The other amateur gave all the assistance to make communication with the usual available to all.

50 Mc has "grown up" overseas and apparently the change is not welcomed by many. Here in Australia the old operating courtesy remains.

The days of the past will, however, return as the sunspots disappear the band loses it's DX attraction and the VHF gang continue on their quiet unmolested way.

The W's did eventually obtain their requested special CW allocations on the VHF bands. The sub-bands as granted were, however, not where they hoped they would be located.

The F.C.C. was petitioned by the A.R.R.L. for the assignment of 100 Kc segments on the low end of the 50 and 144 Mc band. The F.C.C. granted exclusive CW sub-bands from 50.9 to 51.0 Mc and 147.9 to 148.0 Mc.

Currently practically all CW operation has been restricted to the low ends of both bands and there are many disadvantages in making a change to the special segments as granted.

The CW gang on the VHF bands have been responsible for most of special propagation studies, as their mode of emission lends itself to communication under fringe conditions.

However, weight of opinion as expressed by many amateurs to the F.C.C. was against the granting of low-end privileges.

MUCH COMMENT

Judging from the comment the proposal raised wide reaction among amateurs, especially from the telephony enthusiasts. The commission concluded that the public interest will be served by establishment of 100 Kc CW segments but not on the lower sections of the bands as proposed.

The F.C.C. also pointed out that other portions of the 50 and 144 Mc bands have only insignificantly different propagation characteristics and therefore are suitable for establishment of the desired "CW" bands.

The biggest problem for CW VHF workers will be modifications to their stacked multi-element arrays especially with the 144 Mc band variations.

The low end of 50 Mc is the recognised world-wide segment for DX working and it is doubtful whether many of the W, CW stations will forsake this segment for the new allocation.

Other regulatory changes under discussion in the U.S. include the following:

Request for special teleprinter operator privileges.

Permission has been requested for unlicensed persons to communicate by amateur radio using radio teleprinters under the control and supervision of the station licencee.

Teleprinters provide a fast and accurate means of communication in times of emergency. Amateur teleprinters could handle an immense volume of traffic in and out of a disaster area.

Qualified typists can quickly learn to operate teleprinter keyboards and could help to expedite distress traffic. It would leave technical persons available for other duties.

The F.C.C. has proposed regulation amendments to cover the above contingency and also has suggested other variations. The exact terms of the proposition are of interest as they cover the operating requirements of U.S. amateurs. They can be compared with regulations here.

Latest news after preparing the above notes concerns the decision of the A.R.R.L. to petition to the F.C.C. for a rehearing on the proposed new sub-bands for CW at 50 and 144 Mc. The F.C.C. has granted a stay of proceedings until March 10.

An interesting point brought forward by one of the phone gang is his concern about his obituary notice. He mentions that he is over 50 and his days are numbered. It is with regret he considers that the name and callsign will be listed under "Silent Keys."

(Continued on Page 115)

A REVISED LIST OF PREFIXES

The following is the latest countries and prefixes heard on the A.R.R.L official DXCC rating.

Since the last list was published there have been many changes, especially in the West Indies area. The number of countries listed under the prefix VP2 have been increased. There are also among additional countries, a considerable number of them represented on the amateur bands by DX-peditions only. For DXCC A.R.R.L. the list is as follows:

AC3—Sikkim. AC4—Tibet. AC5—Bhutan. AP2—Pakistan. BV (C3)—Formosa. C (unofficial)—China. C3—see BV. C9—Manchuria. CE—Chile. CE9AA-AM. KC4. LU-Z. VK Zero. VP8. ZL5 etc.—Antarctica. CE9—see VP8. CE Zero A—Easter Is.. CE Zero Z—Juan Fernandez Archipelago. CM. CO—Cuba. CN2—Tangier. CN8—Morocco. CP—Bolivia. CR4—Cape Verde Is., CR5—Portuguese Guinea. CR5—Principe Sao Thome. CR6—Angola. CR7 Mozambique. CR8—Goa. (Portugese India). CR9—Macau. CR10—Portuguese Timor. CT1—Portugal. CT2—Azores. CT3—Madeira Is.. CX—Uruguay. DJ. DL. DM—Germany. DU—Philippine Is.. EA—Spain. EA6—Balearic Is.. EA8—Canary Is.. EA9—Ifni. EA9—Rio de Oro. EA9—Spanish Morocco. EA Zero—Spanish Guinea. EI—Republic of Ireland. EL—Liberia. ET2—Eritrea. ET3—Ethiopia. F—France. FA—Algeria. FB8—Amsterdam and St. Paul Is.. FB8—Comoro Is.. FB8—Kerguelen Is.. FB8—Madagascar. FB8—Tromelin Is.. FC (unofficial)—Corsica. FD—Togo. FE8—French Cameroons. FF8—French West Africa. FG7—Guadeloupe.

FK8—New Caledonia. FL8—French Somaliland. FM7—Martinique. FO8—Clipperton Is.. FO8—French Occania. FP8—St. Pierre and Miquelon Is.. FQ8—French Equatorial Africa. FR7—Reunion Is.. FS7—Saint Martin. FU8. YJ1—New Hebrides. FW8—Wallis and Futuna Is.. FY7—French Guiana and Inini. G—England. GC—Channel Is. GD—Isle of Man. GI—Northern Ireland. GM—Scotland. GW—Wales. HA—Hungary. HB—Switzerland. HC—Ecuador. HC8—Galapagos Is.. HE—Liechtenstein. HH—Haiti. HI—Dominican Republic. HK—Colombia. HK Zero—Archipelago of San Andres and Providencia. HL—Korea. HP—Panama. HR—Honduras. HS—Thailand. HV—Vatican City. HZ—Saudi Arabia. I—IT1—Italy. I—Trieste. I5—Italian Somaliland. IS1—Sardinia. JA. KA—Japan. JT1—Mongolia. JY—Jordan. JZ Zero—Netherlands New Guinea. K. W—United States of America. KA—see JH. KA Zero. KG6I—Bonin and Volcano Islands. KB6—Baker. Howland and American Phoenix Is.. KC4—see CE9. KC4—Navassa Is.. KC6—Eastern Caroline Is.. KC6—Western Caroline Is.. KG1—see OX. KG4—Guantanamo Bay. KG6—Mariana Is.. KG6I—see KA Zero.

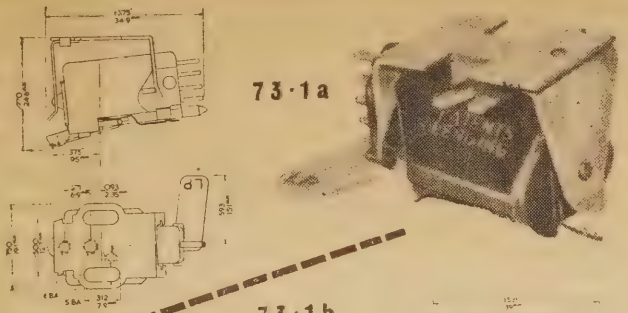
KH6—Hawaiian Islands. KJ6—Johnston Is.. KL7—Alaska. KM6—Midway Islands. KP4—Puerto Rico. KP6—Palmyra Group. Jarvis Is.. KR6—Ryukyu Is.. KS4—Swan Is.. KS6—American Samoa. KV4—Virgin Is.. KW6—Wake Is.. KX6—Marshall Is.. KZ5—Canal Zone. LA—Jan Mayen. LA—Norway. LA—Svalbard. LU—Argentina. LU-Z—see CE9 and VP8. LX—Luxembourg. LZ—Bulgaria. M1—San Marino. MP4—Bahrein Is.. MP4—Qatar. MP4—Truicial Oman. OA—Peru. OD5—Lebanon. OE—Austria. OH—Finland. OH Zero—Aland Is.. OK—Czechoslovakia. ON4—Belgium. OQ5. OQ Zero—Belgian Congo. OX. KG1—Greenland. OY—Faroes. OZ—Denmark. PA Zero PI1 Netherlands. PJ—Netherlands West Indies PJ2M—Sint Maarten. PX—Andorra. PY—Brazil. PY Zero—Fernando de Naronha. PYO—Trindade and Vaz Is.. PZ1—Netherlands Guiana. SL. SM—Sweden. SP—Poland. ST2—Sudan. SU—Egypt. SV—Crete. SV—Dodecanese. SV—Greece. TH—Turkey. TF—Iceland. TG—Guatemala. TI—Costa Rica. TI9—Cocos Island. UA1, 2, 3, 4, 6—European Russian Socialist Federated Soviet Republic. UA1—Franz Josef Land. UA9. Zero—Asiatic Russian. SFSR. UA Zero—Wrangel Is.. UB5—Ukraine. UC2—White Russian SSR. UD6—Azerbaijan.

UF6—Georgia. UG6—Armenia. UH8—Turkoman. UI8—Uzbek. UJ8—Tadzhik. UL7—Kazakh. UM8—Kirghiz. UN1—Karelo Finnish Republic. UO5 -Moldavia. UP2—Lithuania. UR2—Estonia. VE. VO—Canada. VK—Australia (including Tasmania). VK—Lord Howe Island. VK9—Cocos Island. VK9—Nauru Is.. VK9—Norfolk Is.. VK9—Papua Territory. VK9—Territotry of New Guinea. VK Zero—see CE9. VK Zero—Heard Is.. VK Zero—Macquarie Is.. V0—See VE. VPI—Brit. Honduras. VP2—Anguilla. VP2—Antigua. Barbuda. VP2—British Virgin Is.. VP2—Dominica. VP2—Granada and Dependencies. VP2—Montserrat. VP2—St. Kitts. Nevis. VP2—St. Lucia. VP2—St Vincent and Dependencies. VP3—British Guiana. VP4—Trinidad and Tobago. VP5—Jamaica (including Cayman Islands). VP5—Turks and Caicos Is.. VP6—Barbados. VP7—Bahama Islands. VP8—see CE9. VP8—Falkland Island. VP8. LU-Z—South Georgia. VP8. Lu-Z—South Orkney Is.. VP8—Lu-Z—South Sandwich Is.. VP8. LU-Z. CE9AN-AZ—South Shetland Islands. VP9—Bermuda Is.. VQ1—Zanzibar. VQ2—Northern Rhodesia. VQ3—Tanganyika Territory. VQ4—Kenya. VQ5—Uganda. VQ6—British Somaliland. VQ8—Chagos Is.. VQ8—Mauritius. VQ8—Rodriguez Is.. VQ9—Seychelles. VR1—British Phoenix Islands. VR1—Gibert and Ellice Is.. and Ocean Is.. VR2—Fiji Is.. VR3—Faninng and Christmas Is.. VR4—Solomon Is.. VR5—Tonga Is.. VR6—Pitcairn Is.. VS1—Singapore. VS2—Malaya. VS4—Sarawak. VS5—Brunei. VS6—Hong Kong. VS9—Aden and Socotra. VS9—Maldwe Is.. VS9 Sultanate of Oman. VU2—India. VU4—Laccadive Is.. VU5—Andaman and Nicobar Is.. W—see K. VE1 XF—Mexico. XE4. Revilla Gigedo. XV5—see 3W8. XW8—Laos. XZ—Burma. YA—Afghanistan. YI—Iraq. YJ—see FU8. YK—Syria. YN. YN Zero—Nicaragua. YO—Roumania. YS—Salvador. YU—Yugoslavia. YV—Venezuela. YV Zero—Aves Is.. ZA—Albania. ZB1—Malta. ZB2—Gibraltar. ZC3—Christman Is.. ZC4—Cyprus. ZC5—British North Borneo. ZC6—Palestine. ZD1—Sierra Leone. ZD2—Nigeria. ZD3—Gambia. ZD6—Nyasaland. ZD7—St. Helena. ZD8—Ascension Is.. ZD9—Tristan da Cunha and Gough Is.. ZE—Southern Rhodesia. ZK1—Cook Is.. ZK1—Manihiki Is.. ZK2—Niue. ZL—Chatham Is.. ZL—Kermadec Is. ZL—New Zealand. ZL5—see CE9. ZM6—British Samoa. ZM7—Tokelau (Union) Is.. ZP—Paraguay. ZS1, 2, 4, 5, 6,—Union of South Africa. ZS2—Prince Edward and Marion Is.. ZS3—South-West Africa. ZS7—Swaziland. ZS8—Basutoland. ZS9—Bechuanaland. 3A—Monaco. 3V8—Tunisia. 3W8. XV5—Vietman. 4S7—Ceylon. 4W1—Yemen. 4X4—Israel. 5A—Libya. 9G1—Ghuna. 9K2—Kuwait. 9S4—Saar. and without prefixes—Aldabra Island. Nepal and Republic of Guinea.

You will see from the list the great number of additions made in the last few years. Judging from the number of DX-peditions scheduled for 1959, the list will grow even larger.

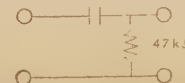
acos

Crystal stereophonic cartridge



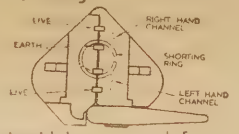
The "ACOStereo" 73-1 is a universal cartridge designed to play stereophonic and monophonic discs, including 78 r.p.m. coarse groove records. Three brackets are available. The "a" bracket fits the majority of arms, the "b" bracket fits Garrard RC. 110 and RC. 120 changers, and the "c" bracket is intended for American arms of the VM type.

The output from the "ACOStereo" 73 is flat when fed into a 2 Megohm impedance. If record compensation is available in the amplifier, it is advised that the output is converted to constant velocity characteristics by feeding through this circuit:—



The left-hand channel is defined as the channel reproduced by the left-hand speaker when viewed by the audience, and is recorded on the left-hand groove wall when the record is viewed as:—

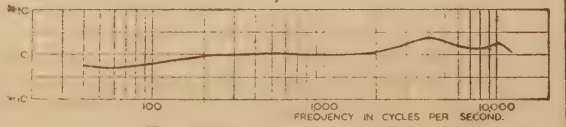
The "ACOStereo" cartridge connections as seen from the rear:—



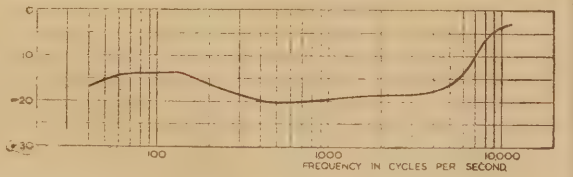
The shorting ring should be removed for use with amplifiers requiring separate leads.

PERFORMANCE OUTPUT—160 m.v. at 1 cm/sec.
Average—300 m.v.

FREQUENCY RESPONSE—
40—12,000 c/s.
SEPARATION between channels at
1 K/cs better than 20dB.
Radii of Stylus tips—0.0005" (13.5 microns).
0.0025" (62 microns).
Recommended load: 2 Megohm.
(Compliance equals 3.5 ucm/dyne).
(Stiffness equals 0.0286 x 10 dynes/MM).
Recommended downward pressure: 3-4 Grammes.
The Stereo recording characteristic is within ½dB of the RIAA/BS 1928-1955 characteristics, and cross talk is better than —20dB at 1 K/cs.



Frequency response on PS.131.



Separation between Channels on PS.131.

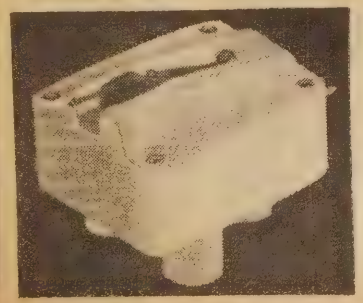
The response of both channels will be within 3dB.

All 73 series cartridges are available with two sapphire, sapphire and diamond, or two diamond styli.

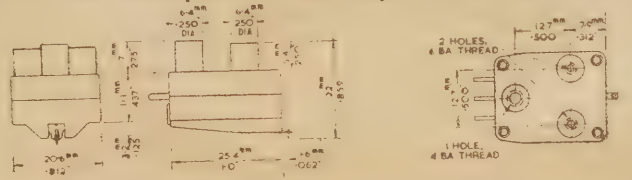
Prices: 73 series—Cartridge incl. 2 sapphire styli, £5/15-—with sapphire and diamond styli £11/18/6—with 2 diamond styli £15/19/6.

Available ex stock.

"How Stereo Works" gladly posted on request.



71-3 For stereophonic discs only (non turnover type)



With sapphire stylus — Price £4/9/6
With diamond stylus — Price £10/17/6

Australian Agents

AMPLION (A/SIA) PTY. LTD.
101 Pyrmont Bridge Road, Camperdown,
SYDNEY, N.S.W.

Wicen in action

DURING the serious February cyclone which caused extensive damage on the central Queensland coast and later to move down south to Sydney, radio amateurs were active in emergency.

The VK4 Division's WICEN organisation was very active and could be heard working on emergency frequencies over a number of days. Details of the operation are not available.

The N.S.W. WICEN group was alerted by the Civil Defence Organisation on February 10, but other than for some local flooding no damage was caused.

Normal communication was not interrupted at any stage. It is interesting to note that in the U.S. radio amateur communication was reported on QST to have been utilised in 72 major and minor emergencies during 1958.

Amateurs provided communication in a wide range of disasters from lost person searches, forest fires, tornadoes, plane crashes, snowstorms to floods. In some of the major disasters over 100 stations were participating handling emergency traffic.

DX on 50mc.

THE JAs came through again on 50 Mc in February and early March. The VK4s, VK5s and nothern VK2s were among them. One appeared on the band in Sydney in mid-February and caused quite a furore. Later in the month they came through in earnest and in one session on February 24 Adrian Rofe, VK2HE contacted 10 JAs.

The N.S.W. VHF and TV section have decided to conduct their nocturnal DF and FOX Hunt events on a handicap basis. The number of cars competing in these searches is on the increase. The handicapping system will add more interest as various section members have had a mortgage on the events over the years. The contest held late in February resulted in a win for John Lark, VK2ZAV, second Dave Andrews, VK2AWZ, and third Dick Norman, VK2ZCF. 10 cars were active in the search.

The section's Autumn Field Day is scheduled to take place on April 12th. The event will be held as a message handling competition and full rules will be circulated later.

WIA activities

LECTURER at the February meeting of the N.S.W. Division of the WIA was S.S.B. advocate Dr Leo McMahon, VK2AC. His subject "Cheapest and Easiest Single Side Band" was covered in his inimitable down to earth style.

Leo described many angles of S.S.B. working, the construction of suitable equipment and where and how to acquire some of it. In order to make the lecture and accompanying diagrams available to country members Joe Reed, VK2JR, is preparing suitable slides and Leo is recording a special lecture.

Other subjects discussed in general business included the proposed new badge designs — members were emphatic that the old badge should be retained.

The N.S.W. Division's QSL Bureau under Frank Hine, VK2QL, handled 32,500 cards during 1957 comprising 14,500 in and 18,000 outward. Members were very pleased with the service rendered, especially with the dispatch of the cards with the Monthly Bulletin.

The Annual Meeting and Election of Officers of the N.S.W. Division of the WIA will be held this year in April, the Easter holidays interfering with the normal March meeting date.

It is hoped that all members who can possibly attend will do so.

The venue: Science House, Gloucester Street, Sydney, April 24.

Outcome of the WIA's Federal Convention held over Easter in Melbourne will be watched with interest. Delegates deliberated over a long agenda paper and propounded the views of the various State Divisions. This convention is the most important event in the administrative side of the Institute and decisions reached each year represent the views of the majority of the Divisions

DX visitor

WELL known visitor to these shores Bill Elich, W6AL, will again arrive in Australia late in March. Bill is famous for his antenna farm and potent signal reaching Australia. He will look up his many amateur friends some with whom he has contacted weekly over many years.

Bill was first in Australia early in the twenties as wireless operator on the old TransPacific ship the Ventura and was last here in 1956 when he visited many shacks

Ham story

"The Sydney Morning Herald's" serial "The Land God gave to Cain," by Hammond Innes, run in March is based to some degree on amateur radio. The plot centres around an "S.O.S." received by a G amateur from Labrador.

Descriptions, prefixes, jargon are authentic and the author is well versed in the ways of the radio amateur. Amateurs may care to read it.

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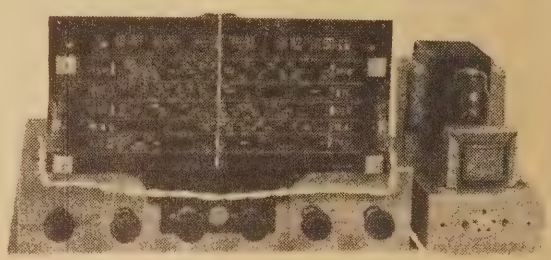
STEREOPHONIC RADIOGRAM

Sound faithfully reproduced to give utmost realism in your own home. You can hear every instrument with lifelike clarity and full directional effect of natural sound from 2 speaker systems with 2 audio channels synchronised volume and bass and treble boost controls. Designed for the new stereo discs but 100 per cent better sound from your present microgroove or standard recordings.

10 valves, 6BA6, 6AN7, 6BA6, 6AV6, EM80, EF86, EF86, EL84, EL84, 5V4. Dual Wave. Tuned R.F. stage. Input for stereo monaural. Mike, TV Tape Recorder. 2 Rola Twincone Speakers.

£47/15/0



8 VALVE STEREOGRAM CHASSIS

Dual Wave Bass and Treble Boost. 2 12in Jensen Speakers.

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Twin Chassis. Twin Push Pull Hi Fi Amplifier. 14 watts of wide range reproduction. 4 Jensen speakers ensure 100 per cent better quality on radio or your present records and superlative quality on the new stereo discs.

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R. and H. Stereogram Kit including Control Box.

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Wired and Tested. £57.

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Kitset including cabinet

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Wired and Tested. £29.

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6V Input, 60 watts. 50 cycles 12V Input. 100 watts. 50 cycles Suitable for Radiograms. Tape Recorders.

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Wired and Tested . **£45/-/-**

7 transistor set as above. **£45**

Wired **£48**

R. TV & H. 58 21in THE COMPLETE KIT

£118

Wired and Tested

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Q plus KITS

17in **£119**

21in **£127**

Complete kit, including picture tube.

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£12 extra

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Public Address Range 240v-AC

6 Valve, 10 watt, **£14/17/6**

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Battery Operation

6 Valve 6v 10 watt, **£18/15/**

7 Valve 12v, 12 watt, **£19/15/**

7 Valve 12v, 25 watt, **£24/17/6**

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Steans, Philips, AWA Mullard, Astor

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90 degree

14"	**£22/-/-**
17"	**£24/-/-**
21"	**£31/15/-**
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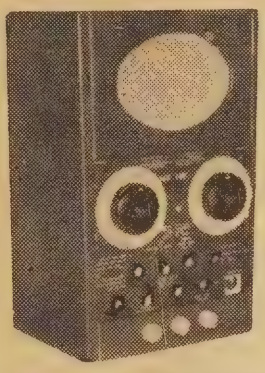
DULWICH HILL, UNDERCLIFFE, EARLWOOD, BUS AT DOOR, STOP No. 42



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211	£1
803	£1/5/
805	£2/10/
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Series wound Hi-speed miniature 12,000 R.P.M. £2/10/

Shunt wound with gearbox, 2 speed and 5 and 25 R.P.M. £2/10/

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Rack Mounting. Good Order.

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Throat Mikes, New 3/6

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Suitable for TV Pic. Tubes.

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12v operation. 2 to 10 Megs. Air tested. Perfect order. Complies with P.M.G. requirements. For small ships, bushfires and all other services.

COMPLETE WITH 1 CRYSTAL

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2-mile Drums.

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Complete with Valves and Circuit Good condition.

£4/17/6

Postage, N.S.W., 7/6, Interstate 10/

6V VIBRATOR POWER SUPPLIES

200V Filtered Output. Ideal Car Radio, etc. Tested. Good Order.

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Other voltages available.

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VT501	12/6	12SL7	12/6
2D21	15/	39/44	10/
1C6	12/6	46	12/6
1J6	12/6	47	12/6
6A6	12/6	78	12/6
3A4	15/	828	£2/10/
3B7	10/	843	£1/10/
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CV6	3/6	1C7	2/
6F6	12/6	5A5	7/6
VR65A/SP41	2/6	7193	3/6
KT66	27/6	6B8	12/6
6X5	10/	EL3NG	12/6
6V6	12/6	83	10/
1Q5	2/6	EMI	12/6
6F5	12/6	866A	15/
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1T4	10/	EF50	2/
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1L4	5/	5R4GY	£1
VT502	12/6	6AJ5	9/6
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325 x 325 150mA	3 15 0
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350 x 350v extended to 1000V, 6.3, 6.3-2.5 4V filaments

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6V 300V 125mA	£3 12 6
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295V 300MA	6 15 0
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6V 240V 40 Watt	£3 7 6
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6V, 3-Pole Miniature	15/
1700 SPDT	7/6
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½in Square Section DURAL TUBING UP 24 12ft lengths, 1/ per ft.

Hi-lo Phono Transformers 4/6

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Hi-voltage, Lead-thru Insulators, 1/6 each; 15/ doz.

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100 yards	£2/17/6
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£1/17/6

Used Headphones, as above. Tested. Perfect order.

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Postage 2/6.

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Regulated. Filtered. 125V DC.

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Pre Focus. Sealed Beam. 130 watt. 24 to 32 V.

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8-day movement. Cost Govt. £28.

2¾in	£4/15/
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Coils B/C 455 KC	9/6
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Input	Output			
24v.	250v. 100mA	£1	0	0
24v.	550v. 375mA	£2	0	0
24v.	250v. 60mA	£1	5	0
12v.	500v. 350mA	£8	10	0
12v.	1200v. 200mA	£6	10	0
24v.	250v. 100mA, New	£2	0	0
12v.	235v. 50mA	£2	15	0
12v.	350v. 50mA	£2	15	0

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With Gearbox

100 to 1 reduction, 24v. Reversing. Ideal beam swinging unit.

£2/17/6

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Standard P.M.G. Type Pedestal Magneto Phones. Tested, in perfect order.

£6/10/-

NEW 300V AC METERS

Panel Mounting, 3in.

£1/15/-

Postage 2/6.

Vernier Dials

National Velvet.

15/- Post 2/6.

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Communications Receivers. Test equipment. P.A. Gear, Large or Small surplus stock. Best prices. Call, write or phone any time.

Oil-filled Condensers

1UF 600V. 6/6 5UF 400V 6/6

4UF 600V. 6/6 2MFD 2500V 15/

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100 assorted, 40 Values.

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NEW CONDENSERS

25 PF. to 30 MFD.

100 assorted. Mica Paper Electro.

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NEW LABORATORY STANDARD METERS

6in Mirror Scale. Built in Cedar Cabinets, Moving Coil.

0.5 plus 0.10 amp. 500 milliamp

£2/10/- Postage 6/-.

Also

0-110 Volt A.C., D.C. Moving Iron £2/10

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A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

TESTER BOY MULTIMETER

The Tester Boy Multimeter is ideal as a portable instrument for the hobbyist motor mechanic, etc. Dimensions are 6in. high, 2⅜in. wide and 3⅝in. deep.

Weight 11lb 13oz.

Ranges as follows:—
Volts AC and DC 2.5 10, 50, 250, 500, 5000.

Resistance 0-10,000 ohms, 0-100,000 ohms and 0-1 megohm

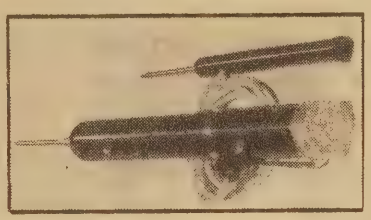
Decibels minus 20db to plus 10db. 0db to plus 22db. By referring to a chart up to plus 56db may be measured.

The case is black bakelite with a metal panel and 3in. meter.

Test leads are provided and also a leather carrying case. Sensitivity of meter is 1,000 ohms per volt.

Price of this unit is

£7/10/-

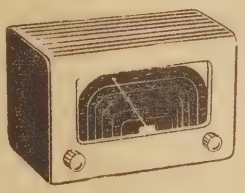


TE106 PENCIL TESTER

This meter is only the size of a fountain pen, clips into the pocket and is ideal for serviceman. Ranges are as follows:—

AC DC Volts 0-12, 0-300, 0-600 ohms 0-50,000. Supplied complete with Test prods.

Price only £3/10/.



ONE VALVE KIT SETS FOR THE LEARNER

Although this little Set is quickly built it looks like a factory job. The wooden cabinet is covered with burgundy leatherette and the dial has all Australian Stations marked in different colours. Parts are mounted on a wooden baseboard and anyone can build it if they can use a soldering iron. Circuit diagrams, wire, solder, etc., supplied. Price of complete kit of parts including Valve, Headphones and Batteries Normal Price £8/5/-.

Our Price, £5/19/6.

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1. **Bargains in Wire**

A. 5mm Rubber Insulated Ignition Cable **Price 3d yd.**

B. Limited quantity of 7 core cable, each core plastic insulated and the whole covered with lacquered woven cotton **Price, 2/ yd.**

C. Enamelled Cotton Covered Copper Wire, ideal for Bell Wire, etc., **1/- doz. yds.**

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★ SPECIALS ★

E. Twin Shielded cab-tyre cable. This is normal twin cab-tyre cable rubber insulated covered with outer braid of tinned woven copper **Price 1/3 yd.**

2. **Rubber insulators** as used in under car aerials. Make ideal shockproof mounts for equipment, can be used for T.V Aerial Insulators. **Price only 1/ ea.**

3. **Sato Crystal Sets.** Miniature Crystal Sets, slug tuned, in bakelite case, indoor aerial and earth leads and headphone provided Worth £3/10/. **Reduced to £2/5/.**

4. **Magnetic Pick-up.** English make, with bakelite arm for 78 R.P.M records, light weight. **Price only 7/6 ea.**

5. **Gramo Pick-ups.** Excellent quality turnover head crystal type, with two sapphire Stylii. Worth £5/15/. **Our Price, £2/15/**

6. **Gramo Pick-ups.** Crystal Pick-ups with separate plug in cartridges for std. and L.P. recordings. Price for arm with standard cartridge only **25/ ea. L.P Cartridge extra, 15/ ea.**

7. **Parts for Crystal Sets.**

A. Miniature 1 gang condenser. **13/9 ea**

B. Crystal set coils No. 1 for metropolitan area, very selective. Circuit provided **Price only 7/6.**

C. Crystal set coils No. 2 for country, very sensitive, circuit provided. **Price only 8/ ea.**

D. Germanium Diodes, English make, brand new and guaranteed, ideal for use as Crystal Detectors, Rectifiers, etc., **Price only 3/11.**

E. Single Crystal Earpieces as used on Japanese Crystal Sets. Brand new and boxed **Only 12/6 ea.**

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G. Red Diamond Crystal Detector Refills **Price Only 2/ ea.**

8. **Suitcase Handles,** moulded bakelite, complete with clips. Ideal for Portable Radios etc., available in Brown and Ivory. **Price only 2/ ea.**

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10. **Morse Practise Sets.** Consisting of morse key, buzzer, battery, etc., on baseboard Ideal for learning the Morse Code. **Price 15/ ea.**

11. **7C7 Valves.** Brand new and boxed. These valves are high gain R.F. Pentode with 6-3 volt filament and loctal base. **Sacrificed for 3/9 ea.**

12. **Local Sockets** to suit above valves. Brand new. **Price 2/9 ea.**

13. **40 ma Power Transformers,** well known make, new and boxed. Flat or vertical mount types available
Primary—240 volts.
Secondary—240 volts aside.
Filament—6.3 volts at 2 amps. Worth 54/ **Our Price 29/ ea.**

14. **2-piece Telescopic Car Aerial.** Chrome plated side mount type. **7/6 ea.**

15. **Single section** Cowl-fender car aerials suit Holden, etc. Stainless steel rod used single hole mounting. A real **Bargain for 15/ ea.**

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Branches throughout Victoria and Riverina

A 5-Valve Stereo Radiogram

(Continued from Page 39)

The amplifiers naturally sound best with the best speakers, but you will probably be interested mainly in those which suit the total outlay needed for the chassis.

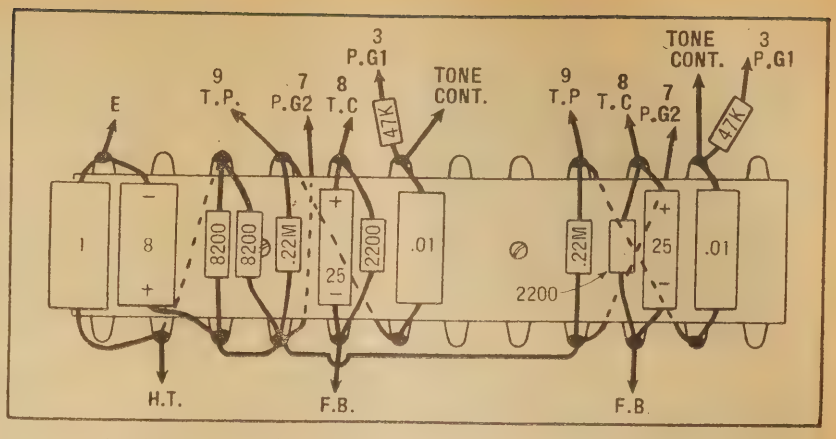
Again we suggest you can't go wrong with a pair of speakers mounted in our baffled enclosure, which we have mentioned many times, and which seems to be as popular as ever.

We have used both 12-inch and 8-inch speakers in it and they both work well. The 12-inch types have the advantage of a larger cone area and produce the most impressive bass, but smaller wide-range types such as the 8MK are quite good.

We strongly suggest that you use two of the same or similar type, not only because the sound blends best, but because the efficiency is likely to be more nearly matched. Where there is not enough total output to waste any of it, it is not good practice to use any but the highest efficiency speakers.

When locating the speakers, try to get them well separated, and so that you can sit at least as far away from them as they are separated. If your room is oblong, as most are, then two corners on one of the short sides is far the best. Placing the speakers in the corners of the room helps to give better bass, and will generally be found the best.

However, the proof of the pudding is in the eating, and experiment is generally the best guide.



This diagram shows how the components mounted on the strip are wired.

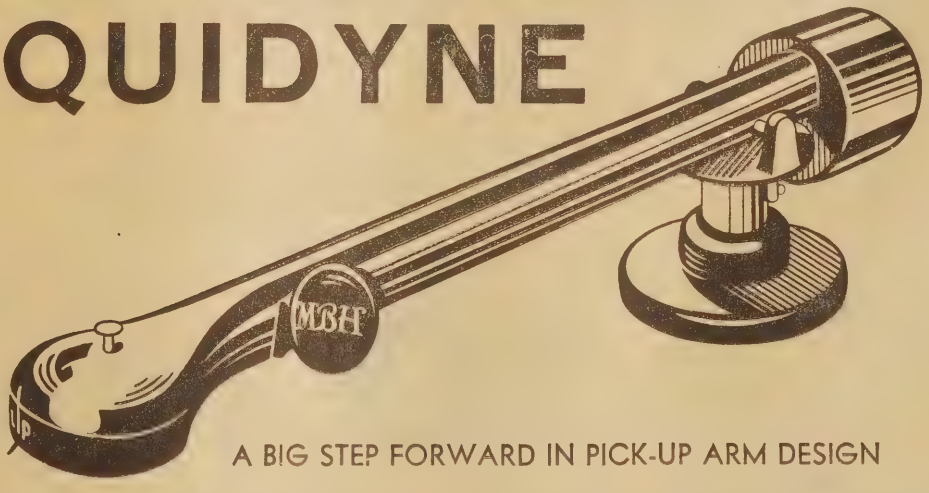
So there it is, just about the simplest stereo radiogram you can imagine. It is, of course, intended for use with crystal pickups, which alone have enough output to drive it. The amount of feedback we have used should allow the amplifiers to be loaded up on full peaks of sound, as there is everything to be gained by using as much of it as possible. Variations of the total amount down to about 12 db is permissible to give higher gain, but we strongly suggest you keep to our suggestions, even if it means advancing the volume control more than you may be used to.

There is no point in having so much gain that you must throw most of it away by keeping the control right back. Our experience has been that there is enough gain to increase feedback rather than to decrease it. By changing the value of the feedback resistor from 2200 ohms to 1200 ohms, the total value for each channel when balanced rose to 18 db, and a typical crystal pick-up was still able to fully load the amplifiers on loud passages.

With the transformers used stability on speaker load and long leads was still more than adequate, and in most cases it should be permissible to operate your version in the same manner.

The phasing capacitor will probably not need any change in its value with this alteration.

EQUIDYNE



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The new M.B.H. EQUIDYNE arms feature an exclusive TORSION SPRING PIVOT CONSTRUCTION (patent applied for). This cancels the side-pull present in all other pick-up arms.

The cancellation of side-pull confers many advantages, some of which are:—An increased stylus life of at least three times. A reduction in distortion, esp ecially near the record-centre. A reduction in surface noise. A reduction in some types of record-rumble.

Available in 4 lengths; 9in and 12in (for records up to 12in diameter), 14in and 16in (up to 16in diameter).

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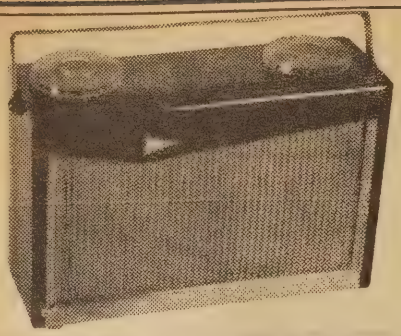
IT'S BETTER TO EQUIDYNE YOUR RECORDS

HIGH FIDELITY PRODUCTS, 19 MARLBOROUGH ROAD, HOMEBUSH, N.S.W.



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Post extra.

SET WIRED AND TESTED £2 EXTRA

INCLUDING 6 S.T.C. TRANSISTORS, R.C.S. COILKIT WITH PRINTED CIRCUITS, ROLA TRANSFORMERS AND 5F SPEAKER & ALL PARTS NECESSARY TO COMPLETE THIS SET INCLUDING ATTRACTIVE & DURABLE TWO-TONE CABINET WITH GOLD TRIM.

7 TRANSISTOR PORTABLE

Specifications as above but with extra I.F. stage, giving better range and selectivity, also has extra coil for connecting to car aerial, making it ideal as a car set or for country locations.

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Post Extra.

£29

3 TRANSISTOR – SET

(As described in March "Radio and Hobbies")

Complete kit of parts less cabinet. Attractive two-tone covered cabinet 40/ extra. **£10/10/-**

Cabinet size 13in x 10in x 6in.
Weight 11lb.

PORTABLE TRANSISTOR RADIOGRAM

Complete Transistor Six kit with B.S.R. four speed motor and crystal pick-up and attractive two-tone covered cabinet **£35**

As above but with Seven Transistor kit **£37/10/-**

Above sets wired and tested 6 Trans. 55/-. 7 Trans. 75/- extra.

PORTABLE TRANSISTORGRAM

Complete kit including B.S.R. Motor and pick-up (4-speed and attractive two-tone covered cabinet. **£25**

Wired and Tested, £2 extra. Postage extra.

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1C4	4/6	12SK7	7/6	6C8G	7/6	7S	7/6
1L4	10/	EK32	10/6	6SS7	8/6	EL32	10/6
1T4	10/	6SA7GT	9/6	6H6	2/6	6V6GT	12/6
1S5	10/	6SH7	5/6	6H6GT	1/6	VR65A	2/6
3S4	10/	1Q5G	5/	6K7GT	7/9	41	7/6
3V4	12/6	1P5G	5/	6U7G	6/6	7193	3/6
1R5	12/6	1C7G	5/	6J7G	5/	954	2/6
1A7GT	9/6	1K5G	2/6	6F8G	10/6	12A6	10/
1D8GT	9/6					12A6	10/
6A8G	10/6					EF50	2/6
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6SJ7GT	9/6					12SH7	5/
6X5GT	10/					6K7G	4/6
						1C6	7/6

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SPECIAL PRICES FOR QUANTITIES.

("Mercury" American Made.) These relay counters register from 0 to 99,999 can be supplied with 250-ohm coil 24v D.C. operation.

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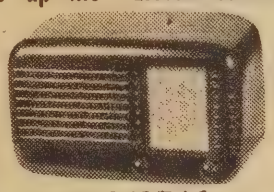
Plus Postage.

TV IF STRIPS

Complete, wired and aligned, supplied with seven miniature valves. (Post extra) **£14/10/-**

TURRET-TUNERS £12/10/-

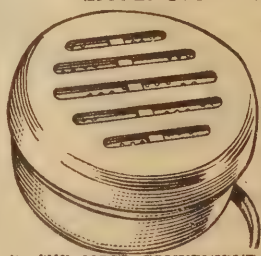
Make up the "LITTLE GENERAL"



£12/17/6

Complete kit of parts for the 1957 "Little General" as featured in R. and H., including attractive bakelite cabinet with slide dial. Price includes valves and Rola 5F Speaker and kit is complete to the last nut and bolt (Set wired and tested £2/15/ extra.)
Cabinet size 11½in long, 7in high, 6in deep.
Foundation Kit for above comprising Bakelite Cabinet, Chassis and Dial Assembly 57/6
Post and Packing: N.S.W., 14/6: Interstate, 25/-.

PILLO-FONE EXTENSION UNIT



IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sick room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The 'PILLO-FONE' IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED.. 3½in Diameter by 1¾in deep.

POST FREE **22/6**

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WITH EM80 "MAGIC EYE" TUNING INDICATOR, SEPARATE BASS, AND TREBLE CONTROLS, ATTRACTIVE PLATEGLASS DIAL AND SUPPLIED WITH JENSEN M.S.P. DUAL SPEAKERS. 12in WOOFER AND 6in TWEETER.

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F.O.R. Packing 10/- extra.

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Boxes of 100 new Ceramic mica paper and electrolytic condensers in values ranging from 50pf mica to 5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500 mfd/12v., 10 mfd/40v., 16 mfd/350v., electrolytics.

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(Standard resistor colour code supplied.)

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for that Crystal Set

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455KC 1¼in square can. Slug tuned.

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New Power Transformers

40mA prim.; 240v with 230v tapping. Sec. 285 x 285 with 6.3v filament winding 60mA.

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40mA Prim.; 250v Sec. 225 x 225 with 6.3v. Fil. Winding Upright or Flat Mounting. Size 2in x 2½in.

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30mA 240v Prim.; 150 x 150v. Sec with 6.3v Fil Winding.

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25,000 ohms. 100,000 ohms., 4/6 ea.	100,000 ohms. 500,000 ohms, 2/6 ea.	50,000 ohms. 100,000 ohms, 3/6 ea.	50,000 ohms. 100,000 ohms. 1/9 ea
500,000 ohms. 1. meg. ohm. 42/- doz.	1 meg. ohm; 24/-.	500,000 ohms. 1. meg. 33/- doz.	500,000 ohms. 1 meg. ohm 16/- doz

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HOT in 6 seconds!

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The only "consumable" parts in the Scope Iron are the copper tip and small element, both of which can be replaced easily by the owner at a cost of a few pence

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NO HEAVY CABLE

The Scope Iron is fed from a low voltage transformer or 4-6V accumulator via a special multi-strand 2-wire cable that gives maximum flexibility

NO DANGEROUS VOLTAGE

The Scope Iron gives maximum safety in that it operates from extremely low voltage The National Scope Transformer available with the iron has an output voltage of 3.3V and is especially designed for maximum protection on the mains input side The National Scope Transformer is fully approved under Prescribed Articles of the Electricity Authority Approval No. N/156.

NO WASTED TIME IN HEATING

The Scope Iron heats instantly, attaining full operating temperature in 6 seconds

SCOPE LABORATORIES MELBOURNE

COUNTLESS MILLIONS OF INSECTS

(Continued from Page 19)

This action is not mere messing about
ie insect is warming up in order to
nerate the power required to get into
e air much the same as a motor must
warmed up for maximum efficiency
Again, like an aeroplane, an insect
efers to take off into the wind if it
n do so. In this way its air speed
greater than its ground speed, and un-
ss it is forced to do so it will not turn
id fly down wind. This it must be
rced to do by some outside agency
ch as when the wind speed becomes
eater than its air speed. It will thus
metimes continue to fly far out to
a, finally falling into the drink to be
voured by some hungry fish.

Most insects produce a musical tone
iring flight. This is caused by the
brations of the wings in the air.
Some interesting work has recently
en done on these wing frequencies with
und frequency meters and oscillo-
opes.
Results have shown that every species
insect has its own frequency of wing
eat and the note or frequency produced
y them have been tabulated. A few
f the wing beat frequencies of the more
mmon insects are listed below:
Mosquito, wing beat 307 Note. D
ove middle C.
Horse fly, wing beat 97 G in second
ctave below middle C.
House fly, wing beat 190. G flat below
iddle C.
Honey bee, wing beat 200. G sharp
elow middle C.
Dragon fly, wing beat 20. E four oc-
ves below middle C.
Cabbage butterfly, wing beat 12. Be-
w human ear receptivity.
So you see there is a pretty wide
ariation in tone-producing beats among
ie insects.

MUSIC BY BARK!

There is a performer overseas who
llected a lot of dogs, each with dif-
rent tones in their voices. By training
em to bark when pointed at, the dogs
anage to bark out a reasonable tune.
Something similar might be done with
sects if one had the patience. By col-
cting a range of insects from the mos-
uito to the dragon fly one could cover
ie whole range if one could find out
ow to make them sing. It wouldn't
und worse than Elvis, anyway.
One of the facts about insects which
mazed me is the most unexpected places
which their ears are found.
The ears of the cicada are at the
ase of the abdomen. Some grasshop-
ers have their ears in their front knees
thers have them in the thorax.
It is not surprising therefore that the
earing capacity of insects is variable.
There are types of caterpillars which
an detect ground vibrations ranging
rom a frequency of 32 cycles per second
over 1000. The little cricket can hear
unds from 50 C.P.S. to 3000 and the
emale can hear the male at thirty feet
istance. It is not recorded how far
way a male can hear a female, but
he is in any way as highly attuned
s the human male it is probably a long
ay.
It is interesting to note that the vibra-
ons heard by the cricket are detected
organs at the end of the pair of tails
t the extremity of the abdomen.

There is a grasshopper called a Katy-did which can hear sounds up to a frequency of 45,000 cycles per second. This is far beyond the range of human hearing.

No one nowadays credits an insect with intelligence. Practically all the activities and behaviour of insects is governed in some way by Nature's laws of chemistry and light. Chemical changes and the production of acids, odours, and so on The production and detection of sounds, sensitivity to light and temperature all act to cause an insect to do just what it does do without prior thought on its part

INSECTS AND LIGHT

An insect's sensitivity to light is an interesting phenomenon.

An insect can detect light either directly through the skin, through simple eyes or through compound eyes.

If the larvae of certain worms are beheaded, removing the eyes and the brain, they will still move toward a light. So will some caterpillars if their eyes are painted over with black paint. Some cave insects who are absolutely blind, will avoid the light from a torch. None of these things can be explained other than that these insects have what is called a dermal light sense

In flight some insects can direct themselves by the light in the sky even when the sun is not shining.

They do this by detecting the polarising of the light by the dust and water vapour in the air. How they do it no one knows.

One has often wondered why a moth will fly into a flame and burn itself to death. It doesn't surely want to do it. It doesn't have any particular liking for a hot flame

What actually happens is that a moth always maintains a constant angle between a light and its body. The light emits rays in all directions and when the moth keeps this constant angle to the light rays as it passes them it follows that it must fly on a spiral course right into the centre of the light source. If the source happens to be a flame — disaster!

SUICIDE OR INSECTICIDE?

Water beetles keep themselves floating the right way up by keeping the light above them. If an artificial light is placed below them they will swim upside down

Thus insects are directed by a wide variety of natural phenomenon. Some are affected by heat and cold, humidity and time and direction of flow of air or water currents. Sometimes an insect can find its food if the odour and temperature are in some exact proportion

Space does not permit me to say more about this fascinating subject but I will say this. Insects are so richly endowed with the facilities for making use of Nature's laws without thought that it is just as well that we have brains and know how to knock 'em.

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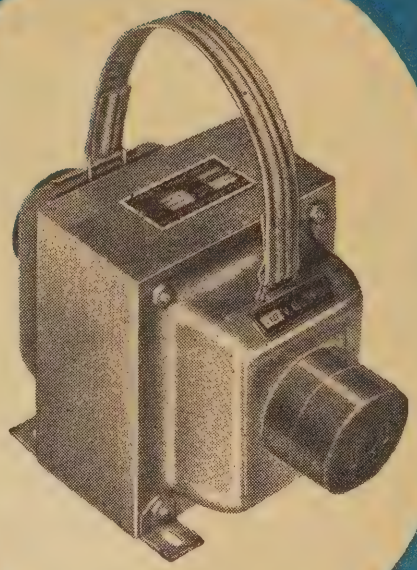
USE A ...



National STEPDOWN TRANSFORMER

110v. APPLICATION GUIDE

Application	Type	Primary Volts	Sec. Volts	Watts	DIMENSIONS H	DIMENSIONS W	DIMENSIONS D	MOUNTING CENTRES A	MOUNTING CENTRES B	OUTLETS No. of
Shavers	A110/25	240V 50 cycles	110V	25	3¾"	3⅛"	3⅜"	2½"	1⅝"	1
Radios, Mixers, Sewing machines	A110/60	240V 50 cycles	110V	60	3¾"	3⅛"	3⅞"	2½"	2⅛"	1
	A110/100	240V 50 cycles	110V	100	3¾"	3⅛"	4½"	2½"	2⅜"	1
Small projectors	B110/175	240V 50 cycles	110V	175	4⅜"	4⅛	4⅝"	3⅜"	2⅜"	1
TV Sets	B110/250	240V 50 cycles	110V	250	4¾"	4⅛	5⅛"	3⅜"	3"	1
Large projectors and other heavy duty appliances	C110/400	240V 50 cycles	110V	400	6⅝"	5¼"	5¼"	3¼"	5⅞"	2
	C110/500	240V 50 cycles	110V	500	6⅝"	5¼"	5¼"	3⅛"	5⅞"	2
	C110/750	240V 50 cycles	110V	750	8¼"	6¼"	4¼"	4¼"	4⅞"	2
	C110/1000	240V 50 cycles	110V	1000	8¼"	6½"	5⅛"	4½"	5¼"	2

Physical Size: Height 4¾in, width 4-1/8in, *depth 5¼in, Mounting Centres 3-3/8in x 3in.

Electrical Specifications: Primary 240 Volts Secondary 110 Volts, Wattage 250W.

* Does not include input and output fittings.

POST THIS COUPON TODAY!

Please forward me details of National ☐ Stepdown Transformers and ☐ Power Transformers and Filter Chokes

NAME .....

ADDRESS .....

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Western Australia: I. W. Helman, Perth. BA8190.

ANSWERS TO CORRESPONDENTS

D.P.D. (Glenside, S.A.) says that he has received short-wave stations on his crystal set and wants to know how it could be.

A. There has been a good deal of correspondence on this subject of late, and it is a wonder that you have not noticed reference to it. All that happens is that some stray resonance effect in your wiring or aerial renders the set sensitive to short-wave signals and you consequently hear one when a strong transmission happens on the frequency to which your set is sensitive. By your circuit, you are connecting a very large aerial to the top of the tuning coil. This is not the best way of doing things and your set would behave far more normally if the aerial were tapped in a few turns from the bottom and an earth were added. We cannot say just why you did not get results from your transistor set, but it is essential to follow the whole circuit and coil specifications given in the article before you can expect success. Apparently your friend is trying to use a standard Reinartz coil, as for a valve, with a transistor. As we stated in the article, the signal pickup from a loopstick is not very great, and you could not expect much from it unless the signals strength of stations is good in your area. You are being optimistic if you are expecting good reception over about 10 miles.

B.S.S. (Central Line, Qld.) submits a query for the "Answer Tom" page of the magazine.

A. Many thanks for your letter, B.S.S. Your query could quite well be of interest to our "Answer Tom" readers, and we are filing it for possible use in a future issue.

D.U. (Cremorne) would like to know the issues containing the "Course In Television" and the "Simple Course in Radio."

A. The Course In Television commenced in September, 1955, continuing until May, 1957, commencing again in July, 1957, to the present month with the exception of November, 1957, and February, May, June, July and August, 1958—January, April, August, September, October. Back copies available from this office are May to November, 1956, December, 1957, and January, 1958, to the current issue at 2/6 per copy. As to the Simple Course In Radio we can supply clear sheets at 1/ each. This commenced in January, 1957, and continued to March, 1958, with the exception of November, 1957.

K.E.F. (Ballarat, Vic.) has a crystal set with a transistor amplifier which has a buzzing sound reminiscent of vibrator interference. The sound is present without the transistor amplifier, but it is not as loud.

A. It would appear that the noise is due to radiated interference such as may come from a high voltage neon or a fluorescent lamp. The addition of the transistor amplifier would then increase the volume of the required signal and the interference in the same proportion. The best we can suggest is that you try to identify the source of the interference and then install your aerial as far away from it as possible. Other receivers in your area may not be troubled, simply because they are more remote from the source of the interference.

G.A.P. (Julago, Qld.) sends some suggestions for a 10-watt public address amplifier using transistors he would like to see described.

A. We have this project in mind for the very near future and have already done some preliminary work to see what type of components could be made available through the trade, etc. We cannot make any definite promises, but very likely the amplifier will appear in an early issue. In the meantime some excellent transistor power amplifier designs are available from Mullard-Australia Pty. Ltd., of 35 Clarence Street, Sydney.

G.R. (Launceston, Tas.) submits a query for the Answer Tom page concerning an odd effect that occurred with a dry joint in his small shortwave set.

A. Many thanks for your letter, G.R. We have passed it on to our Answer Tom writer for possible inclusion in a future issue.

D.K.C.S. (Brisbane, Q.) has a number of suggestions for the Reader Built It page, including an arrangement for including shortwave on a wide-range tuner.

A. Your letter or part thereof should prove interesting to many of our readers. D.K.C.S., and we are filing it for possible use in a future issue.

M.R. (Albert Park) comments about our reply in the February issue to J.G.

A: We did not mean to be "tarty" in our reply and it is unfortunate if the wording gave that impression. At the same time we had to point out what appeared to us as an exaggeration by the magazine in question. It is quite true that, in 1920, iron appeared to be useless as a core material for radio frequency inductors. However, very fine division of iron and the use of cores and derivatives has completely changed the picture so that "iron" cores are now commonplace. There's a lot of chemistry behind it which we don't pretend to know about.

W.M. (Henry Head, N.S.W.) says that he has found that an outside aerial works well with his "Transporta Six" receiver. He used a primary winding of 12 turns wound close to the existing tuned winding. With 15ft of aerial and an earth he was able to tune several interstate stations with the volume barely on. He also heard two or three short wave stations.

A: Thanks for your letter, W.M. The results you have obtained are in line with our expectations but the short-wave stations are a surprise. Aparently sections of your coils and possibly your aerial system are resonant in the short-wave band allowing powerful signals to get through.

S.M. (Fairy Meadow) asks a lot of questions about adapting our home constructed TV aerial design for fringe area use.

A: Frankly, we are not in a position to answer your questions, because we have never had occasion to do any work with aerial systems in areas like yours. It may be sufficient to add extra high-band directors to the aerial but then it may not. The ultimate proof can only be by actual trial at the height you can put the aerial over your particular house. By the same token, we have not considered the implications of stacking the aerials and could not undertake to answer your questions in the few minutes which we can allott to each correspondent. The R. T. and H aerial is representative of a particular approach and you may be able to judge by comparison with commercial installations using the same principles in the same area.

Mr. W. A. Walker has a quantity of old type valves, coils, capacitors, etc. which he is willing to give away to the first junior reader who calls at his home, 40 Trafalgar Ave., Roseville, on a week day between 6.30 and 9 p.m. Thanks, Mr. Walker, for your generous gesture.

D.C. (Fairfield, N.S.W.) says that he has built a 2-transistor receiver but found that he had to reverse the reaction winding to obtain regeneration. He also wants to know about adding a class-B output stage.

A: We would not worry overmuch about having to reverse the reaction connections. Apparently there was some mix-up in the way you interpreted the diagram or the direction in which the winding was put on. The main thing is that it now works. It should be possible to add a class-B stage but we are not in a position to supply a special diagram for the purpose. Alternatively, the little 3-transistor set may have met your need in the meantime.

P.B. (Villawood) asks whether we could send him a circuit and a colour code for resistors.

A: We can supply copies of circuits which have been published in the magazine through the 2/ query service. Simply enclose a 2/ postal note but be careful to explain what type of circuit you want — mains or battery operated, broadcast, short-wave or dual-wave, and whether using new valves or types which you have on hand. With this information we are better able to select something close to what you want.

F.M. (Hawthorn, Vic.) is interested in a circuit from an American magazine. He wants to adapt it to local conditions.

A.: From what you say, the circuit is probably intended to operate from 110 volt DC mains. It could not be used on AC mains since, quite apart from the matter of voltage drop, battery valves will not operate properly with AC on the filaments. It is probable that the receiver could be operated from batteries but it does not follow that it will necessarily be the best proposition. The fact that the circuit shows a 5in loudspeaker is not in itself a guarantee that it will deliver enough power to drive the speaker under all conditions. The simple fact of the matter is that, no matter where the circuit originates, it is still limited to the performance available from two very ordinary valves.

R.M. (Bundaberg, Qld.) says that he gets loudspeaker volume from his one transistor set but that the potentionmeter does not seem to control it.

A.: There's probably quite a deal behind your report on the set which needs explanation. First and foremost, it may be possible to hear the signal through a speaker over quite a considerable distance but that doesn't necessarily mean that we have been unduly conservative in earlier remarks. We base such remarks on undistorted power output, not on maximum loudness. Our judgment would be based on how well the signal could be heard when operating under conditions such that the reproduction was not noticeably distorted. Regarding the potentiometer, our tip is that the regeneration is not working or that you are using the set with too long an aerial. When operating normally, the signals should not be very loud with the regeneration control at maximum resistance. Advancing the control should then increase the loudness of signals until ultimately the set emits a whistle, indicating that it has gone into oscillation. Using the set with too long an aerial for with the aerial tapped too far from the earthed end would give loud signals on the local stations but would reduce selectivity for other stations and would also render the regeneration control ineffective.

I.K.P. (Mitcham, S.A.) has been advised to contact us for information and circuits on the construction of a 240 volt AC radio receiver. I.K.P. is studying radio.

A.: We shall assume the set you require is a mantel type. On that basis we would recommend our "Beginner's Four" receiver featured in a "Learn As You Build" series during the months of June to September, 1958. Back issues of these magazines are available through our query service at 2/6 per copy. Circuit reprints are available also for the normal fee.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

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The AG 3063 stereo pick-up head fits existing pick-up arms of current Record Changers and Players. The Philips **Record Changer** now on the market has an inbuilt counterbalance spring which provides the correct needle pressure when the stereo pick-up head is plugged in. For the popular Philips **Player,** a counterbalance weight has been produced (see below). This reduces the needle pressure to the correct weight with the stereo pick-up fitted.

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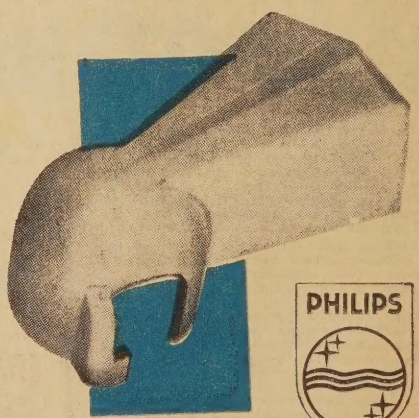

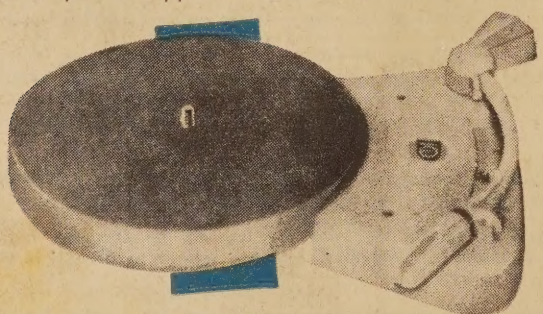

NG 1009 Player showing counterweight and stereo pick-up head fitted.

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L.B.W. (Bombala, N.S.W.) submits an idea the "Reader Built It" page.

A.: Many thanks for the suggestion, which pears to be a good one. We have filed it future use.

L.A. (Guildford, W.A.) wishes to make a port- e radio for a friend. He would like us to ommend a circuit operating both from batteries l the mains.

A.: We can recommend two portables which ve designed for two-way operation with built- power supplies. These are the "Jubilee Port- e," featured in the December, 1951, and 1953 ues, and the "1957 Portable" featured in the cember, 1956, issue. Note that an error exists the case of the latter, in the power supply cuit where the HT and LT dropping resistors shown transposed. Another excellent circuit that of the "Rambler" described in the October, 53, issue followed by a description of a power ply with reactivation in the November issue.

E.W.D., (Mitchum, S.A.) is interested in a ail transistor set to operate a loudspeaker.

A. By this time you should have seen the arch issue which contains a description of type of set you want. It is not possible to ply details of equipment prior to publication the simple reason that the article and draw- s are seldom complete more than a couple days prior to printing.

D.N.F. (Mentone, Vic.) wants to know what ises herringbone patterns in TV receivers. He experiencing this trouble in a commercial re- ver.

A. There are many causes of this effect and would be impossible to say which was to me in your case without a full knowledge of situation and possibly an examination of the . Faulty set design or adjustment can be ponsible, or it can be caused by overloading by nearby electronic equipment, such as dia- rmy, amateur transmitters, or other TV sets. here the trouble is due to an external source the ect probably will vary from time to time as e offending equipment is turned on and off. he trouble will be more consistent if due to e set itself, but may be confined to certain annels. Channel 2 is the most likely offender such cases, due to the second harmonic of e IF falling within the channel. Your best proach would be to enlist the aid of your aler or the makers.

R.S. (St. Kilda) says he has had a lot of easure building up a small transistor receiver d wants to enlarge it.

A. By this time you will have seen the cir- it in the March issue, which should meet your quirements. We have not had the opportunity t of doing any work with a half-inch rod, but will certainly publish any results when avail- le.

J.E.S. (Double View, W.A.) sends us a cir- it of a small set he is using and wants to ow when we will be publishing details of a -valve double superheterodyne short-wave re- iver.

A. Your circuit is a bit unusual, but we uld not expect results to be as good as if you d followed standard practice. With a tap for detector cathode to obtain reaction you could th the rotor plates of the tuning gang and oid hand capacity effects which will almost cer- nly appear as you now have it. Your circuit es not show the bottom end of the volume ntrol connected to earth, and it would not rk properly if you have in fact connected it this manner. At the moment we have no ns for describing such an elaborate short-wave ceiver.

B.W.L. (Madang, New Guinea) is interested the Transporta Seven and wants to know if this n be modified to receive short-wave, and operate th a pickup.

A. The pick-up connection should not present problem. B.W.L., and the method of connec- n was shown in the October, 1958, issue in Transportagram Six. If you do not have s copy we can supply it. The short-wave chan- is not so easy, since the transistors used uld be quite unsuitable for these frequencies. ose types which are suitable are expensive and ll somewhat scarce, so that we have had no portunity to produce any circuits for use with m.

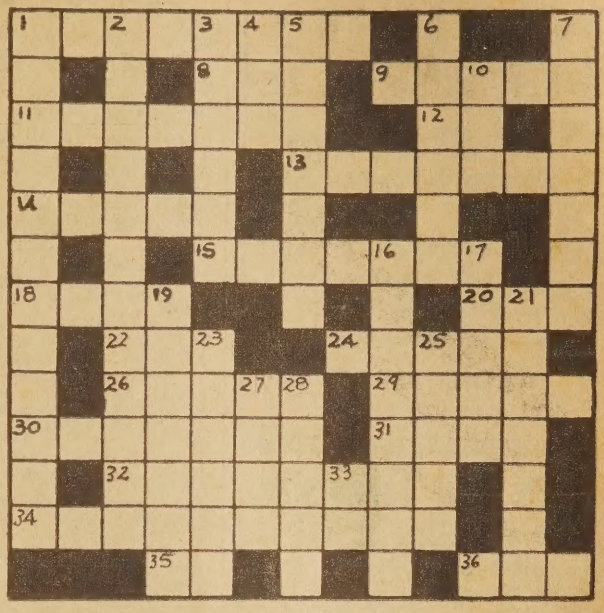
B.M. (Dergholm, Vic.) asks a number of ques- ns concerning the Transporta Seven.

A. Afraid we cannot help very much in the tter of cost, B.M., as this is something best ndled by our advertisers, who are in a far tter position to advise than we are. The set uld be used as a car radio in the sense that can be used in a car and may even be coupled a car aerial if one is available. However, may not always have enough reserve of gain cope with sudden loss of signal in odd spots en travelling in the country. Operation from car electrical system would be most unwise. metal handle is not likely to affect the per- mance of the set.

L.G.H. (Box Hill, Vic.) wants to know if print circuits of commercial radio and TV eivers, where these can be obtained. He also kes some suggestions concerning items he uld like to see described.

A. The best source of supply of circuits for mmercial equipment is the makers. Provided have a good reason for wanting them most nufacturers will co-operate. Many thanks for ur suggestion regarding the field strength meter d we will keep this in mind. Unfortunately, ny of these devices are too insensitive to be of use in fringe areas, which is about the only ce one requires them. To make them efficient these localities calls for a fairly elaborate sign.

THE R., TV & H. CROSSWORD No. 60



ACROSS

1. Excessive loading.
8. Present indicative plural of the verb to be.
9. Sudden burst of light.
11. Cathode is one.
12. Donating an alternative.
13. Actuated.
14. Filtering component.
15. Caring only for personal interest.
18. Part of a sail.
20. Ever (poetic).
22. Creates current of air.
24. Person affected by a disease often considered incurable.
26. Man's name (possessive).
29. An offence requiring punishment.
30. Reluctance of a body to change its state.
31. Negative of gain.
32. Official summons.
34. Body revolving around a planet (pl.).
35. Prefix meaning again.
36. Finish.

DOWN

1. Breaks, where current cannot pass.
2. Name first given to the action of emission.
3. Machine tools for producing cyclindrical work.
4. Mineral containing metal.
5. Antennas.
6. Mocks with contempt.
7. Type of cheese.
10. Part of a circle.
16. Large masses of floating ice.
17. Part of the foot (pl.).
19. Smith that shoes horses.
21. Eating away.
23. To irritate.
25. Indian constables or soldiers.
27. Tuning mechanism.
28. Glossy silk cloth.
33. Demonstrative pronoun.

Solution and further crossword next month

Last month's solution

B	A	N	K	E	D	W	I	N	D	I	N	G		
A	C	E		R		H		O	R			O		
S	E	R	V	I	C	E		R	I	S	K			
S	T	O	I	C		A	M	M	E	T	E	R		
R	A		D			T	E	A	S	E	T			
E	T	T	E			S		L		P	T			
F	E	R	O	C	I	T	Y		I	D	L	E		
L		E	T	A		O				O	E	R		
E		L	A	D	I	N	G			W				
X		L	P		N	E	O	N		N	E	G		
	S	I	E	V	E		W	I	T			U		
H	I	S		I	R	O	N	C	O	R	E	S		
	X		S	E	T		S	E	W			H		

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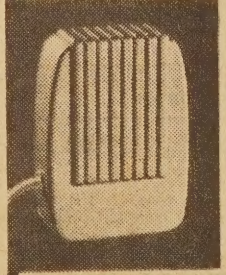

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SELL: Mullard 5/10 Amp £20, preamp £10, tone control £5, Garrard changer, R.C. 80 £15, portable 100W 35 MM slide projector, £7, Mullard Portable £10. **Davis, 97 Greenhill Road, Toorak, S.A. FS035.**

WANTED: Type S. 240V power supply for AR8-AT5, also class wave meter. **C. Patchett, Flint St., Wyalkatchem, West. Aust.**

SELL: Radio and Electronic Components. **F. Quick, 27 Blackwood Avenue, Mentone, Vic.**

SALE: Back nos. R and H. 2/ per copy. Two or more copies 1/6 each, 1956, 1957 copies 3/ each, 1958 copies 4/ each. Prices include postage. Wanted: 1939, 1940, 1953, 1954, 1955, 1956, 1957, and 1958 copies. Best prices paid. **A. J. Cox, 13 Glover Street, Belmont, N.S.W.**

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